Automotive Service Digest

Our 47th year

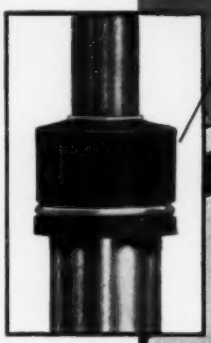
March, 1959

Precision is a key to fuel efficiency—See pages 16 and 52.

Only Perfect Circle gives you

2-WAY POWER PROTECTION!

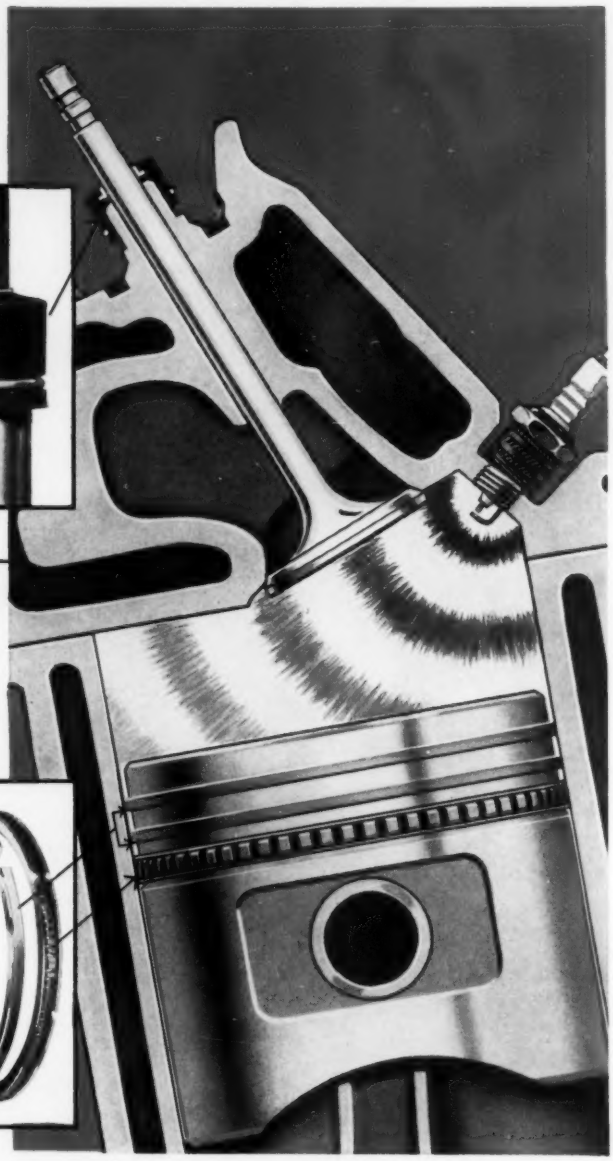
1. Perfect Circle Valve Seals



solve problem of excessive oil consumption past valves!

New rings and restored valve efficiency produce higher compression pressures—and higher deceleration vacuum. Increased vacuum draws oil through loose and worn valve guides. Stop this loss with *new* Perfect Circle Valve Seals!

Be sure of customer satisfaction—Install Perfect Circle Valve Seals on all re-ring and valve jobs.



2. Perfect Circle 2-in-1 Chrome Sets

solve problem of excessive oil consumption past pistons!

2-in-1 Chrome sets provide the finest piston rings obtainable! Top rings and oil rings are plated with thick, solid chrome. Doubles life of cylinders, rings, pistons. No tedious break-in is necessary, rings are pre-seated at factory.

Be sure of customer satisfaction—Install 2-in-1 Chrome sets for thousands of extra miles of power protection and positive oil control!

PERFECT CIRCLE

PISTON RINGS AND POWER SERVICE PRODUCTS

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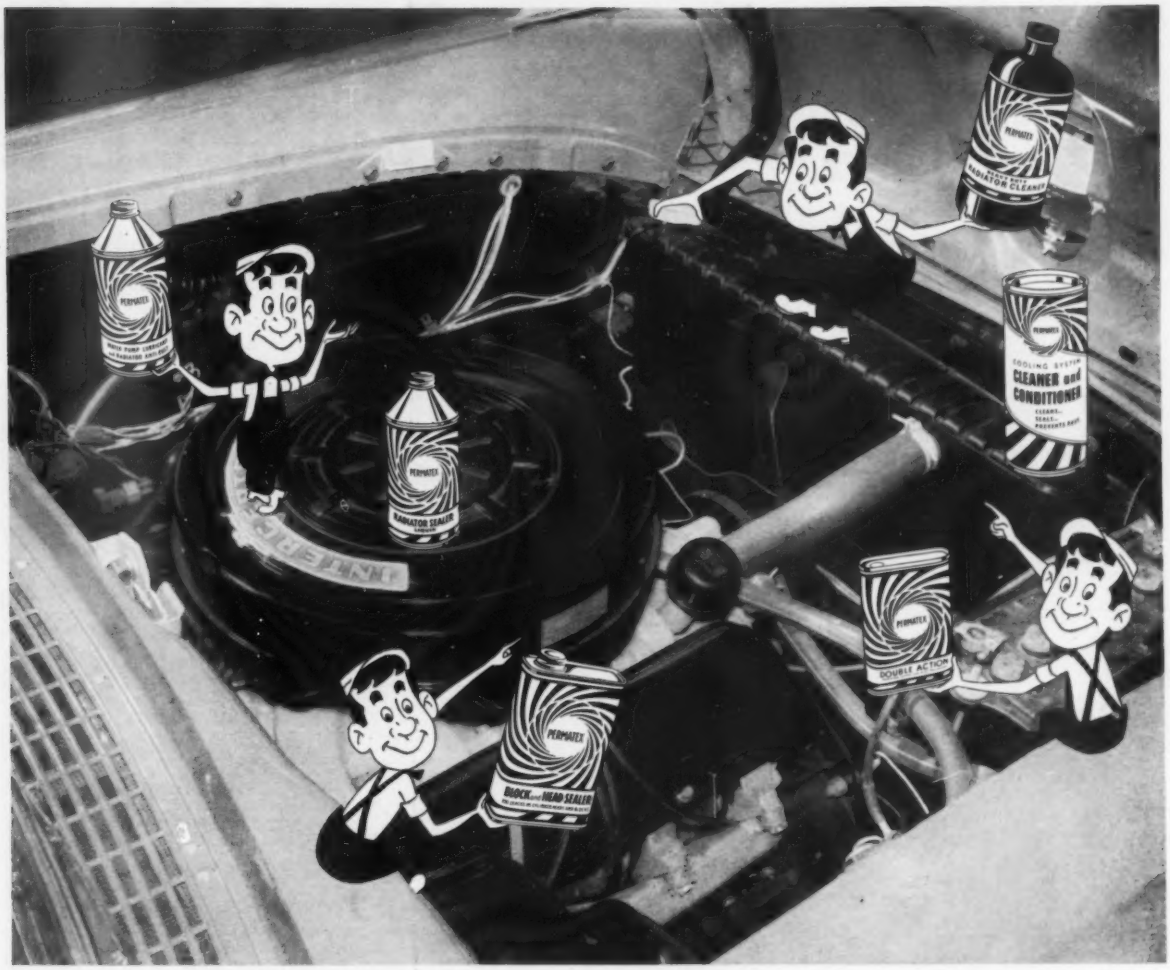
Don Mills, Ontario, Canada



WHATEVER A COOLING SYSTEM NEEDS... A PERMATEX PRODUCT FITS IT BEST

Radiator to water pump to water jacket . . . cooling systems can be headaches . . . and Permatex provides the aspirin. From major leak sealers like Block and Head Sealer to rust preventives like Water Pump Lubricant and Radiator Anti-Rust . . . Permatex has tailored the *exactly* right product to make the job easy and profitable. *Be prepared* with these Permatex products: DOUBLE ACTION RADIATOR CEMENT . . . HEAVY DUTY RADIATOR CLEANER . . . WATER PUMP LUBRICANT & RADIATOR ANTI-RUST . . . BLOCK AND HEAD SEALER . . . RADIATOR SEALER (liquid) . . . COOLING SYSTEM CLEANER AND CONDITIONER.

Send for your copy of the Permatex Catalog . . . which tells you how and where to use every member of this famous automotive chemical family. Ask your jobber or write us.

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Champion Service

A fast, easy way to see if a burned, or "traffic-fouled"

With Champion's new "Check-a-Plug" card you can show customer condition of his plugs while he is still behind the wheel. And the card does your *selling* for you! *(See far right)*

Champions are engineered for every car made by Ford, General Motors, Chrysler, American Motors, Studebaker-Packard, and every major foreign maker

America's favorite—

CHAMPION

SPARK PLUGS

CHAMPION SPARK PLUG

Engineers announce...

car's spark plugs are worn, —the "one-plug check"

Looking at just <u>one</u> plug tells condition of <u>all</u> plugs in most cars —and this fast, easy check is a sales-builder that helps you serve your customers better! Here's the story . . .

Champion Service Engineers have studied spark plug sets taken from thousands of cars. An important "by-product" of this research was the discovery that any one plug taken from an engine is *usually* about the same as all the other plugs in that engine.

This is not true in *every* case, of course. But the exceptions to this rule are no problem. If the plug you pull looks good, and the customer is happy with his car's performance, the rest probably *are* OK. If the plug looks bad, you pull the others anyway, for service or replacement.

The "one-plug check" is a fast and easy way to find real prospects for plug service or replacement.

It doesn't take long to pull one plug from *any* car—especially when you have a time- and trouble-saving "Plug-Master" wrench equipped with a *magnetic* "Plug-Mate" socket. Even in the toughest car, it takes less than *3 minutes!* In many cars it takes less than 60 seconds.

By looking at a plug you can spot most of the common reasons for replacement . . . worn electrodes . . . burned electrodes . . . or excessive deposits often formed during start-and-stop driving in traffic.

Half of all cars on the road need spark plug replacement *right now!* Champion's new "one-plug check" gives you a fast and easy way to go after this profitable business. And every time you replace a set of worn plugs, you do your customer a real favor—by helping him get better all-around performance. So—to build profits and serve customers better—make a "one-plug check" on *every* car.

Champion's flex-handled "Plug-Master" wrench and magnetic "Plug-Mate" socket simplify plug removal and installation in any car. Available from your Champion supplier.

Champion's new "Check-a-Plug" card lets you and your men quickly show customer condition of his plugs. Ask your regular Champion supplier about this handy new sales and service tool.

COMPANY · TOLEDO 1, OHIO

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3. Genuine Chevrolet parts are built of the same quality materials and to the same rigid engineering specifications as the originals.
4. Your Chevrolet dealer has profit building service aids to help you serve Chevrolet owners.

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VOLUME XXXXVII
No. 566

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March 1959

Automotive Service Digest

Cover Subject

Demonstrating craftsmanship in fuel control system service are two students participating in the UMS Post Graduate Apprentice School for Future Automotive Technicians of America, at the G.M. Training Center, Minneapolis.

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Technical help for the service shop

Tech Know-How articles cover how-to and what's new in approved, up-to-date shop practices, as seen and understood by men experienced in the trade. ***Business Know-How***, the dollar-sign side of automotive service work; ***Service Education***, the who-what-where-how of today's trade training.

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Automotive clinic

Stuck on some problem? Need help on a job? Write us about your problem on your shop letterhead and the information you are looking for will be promptly sent you.

Address your letter to Automotive Clinic c/o AUTOMOTIVE SERVICE DIGEST, 900 S. Wabash Ave., Chicago 5, Ill.

Ben Ikert, Editor

Transmission Whine

A customer's Ford-O-Matic equipped 1957 Ford Fairlane 500 developed a whining noise (more of a whistle) after 3500-4000 miles of use.

After this car sets for 6 or 8 hours and is then driven, this noise comes in at 35 m.p.h. and leaves after the car reaches 45 m.p.h. The noise is quite loud at first and gradually leaves after driving for four or five miles.

The noise comes and goes with car speed only, engine speed has no effect. In fact, the noise is the same when drifting down a hill with engine off or gears in neutral. The noise is the same when pulling, coasting or at even speeds . . . as long as the speed is from 35 m.p.h. to 45 m.p.h. However, it is more pronounced at 40 m.p.h. We have eliminated tire noise.

We have replaced grease seals in the rear wheels and the pinion seals. We took off the driveshaft and pushed the car up to speeds of 50 m.p.h. There was no noise at all. We put the driveshaft back and the noise was there again. While the driveshaft was down, we found the rear universal joint rough, so it was replaced, and the front joint was repacked.

We have come to the conclusion that this noise is in the rear part of the automatic transmission. What do you think? *G.L.K., Cresaptown, Md.*

Answer: The first thing to do is to locate the source of the noise. If there is a dynamometer in town, put the car on it and run at speeds of 35 to 45 with various loads and see if you can localize the noise from different positions in and around the outside of the car. Another way would be to put the car on a hydraulic lift (frame contact) with someone in the car to operate it, and raise it high enough so you can get under the car with a soundscope. Have the driver run the engine in drive and see if you get the noise with the engine unloaded. Then apply the brakes gently for a few seconds at a time and see if you can bring in the noise. If so, use the soundscope at different points under the car—at transmission, rear axle, car frame, engine oil pan, etc.—to pin point the noise.

Wrong Polarity

Our shop services a '49 Olds which has been giving trouble in starting. In checking it over, we found the coil reversed and further inspection showed the battery was installed with a positive ground. The battery was in about 2 months. Another battery was installed with the proper ground, we flashed the generator fields and started the engine.

The generator charged in the right direction, but if you pulled the light switch, it would show further charge. The regulator would cut in and out, although it is a 6-volt negative ground unit and right for the application. Only by reversing the battery was the correct charging direction obtained.

How can normal conditions be restored on the job?—*D.W.C., Heligh, Nebr.*

Answer: It is possible that someone who worked on this car before you got it, crossed wires some place. The generator should be one of these numbers, 1102704, 1102606 or 1102707, and the regulator should be number 1118300. With the battery negatively grounded, correct generator installed, regulator and wires connected correctly, generator properly polarized, the polarity will be correct.

Check polarity at the spark plugs, which should be negative. To polarize generator, flash across from B regulator terminal to the A terminal. Examine regulator contact points as with operation on reversed current polarity, they may be in bad shape. Check ammeter connections to be sure someone has not reversed them. Be sure regulator has a good ground and that there is a good ground from body to engine. Sometimes poor grounds will cause faulty actions often hard to diagnose.

Low Oil Pressure

We are having oil pressure trouble with a 1954 Dodge Coronet V-8 which has been driven 85,000 miles. It seems that nothing we do to this engine is right, so far as oil pressure is concerned.

This car has given excellent service until about six weeks ago, at which time the center main bearing went out, along with several of the rod bearings. Upon disassembly of the engine, we found that it had come from the factory with a .010″ undersize crankshaft, and we also found that one lobe on the camshaft was down .147″.

Since this engine had more than the usual amount of varnish and gum deposits, extra effort was made to insure that all oil passages were open and full size. This was done by using the proper size twist drills by hand.

We had the crankshaft reground to .030″ undersize and fitted with proper inserts. A new camshaft was installed with new bushings; also a new timing chain, new hydraulic valve lifters, new rod inserts, new oil pump, new rings, new gaskets and seals throughout. We even ground the valves; in fact, we did just about everything to this engine short of re-boring and installing new pistons and rods.

The engine runs perfect—no knocks or rattles—yet upon driving at moderate speed for about twenty miles the oil pressure drops well below the normal 45 p.s.i. mark when using 10W oil; not quite as low when using 20W oil, and only slightly below normal with 10W-30 oil. Engine temperature ranges on the low side of normal.

With a leak detector attached to the engine and pressure maintained at 45

(Continued on page 12)

WHEN CHANGING YOUR ADDRESS

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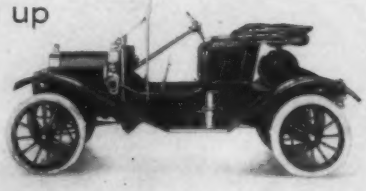

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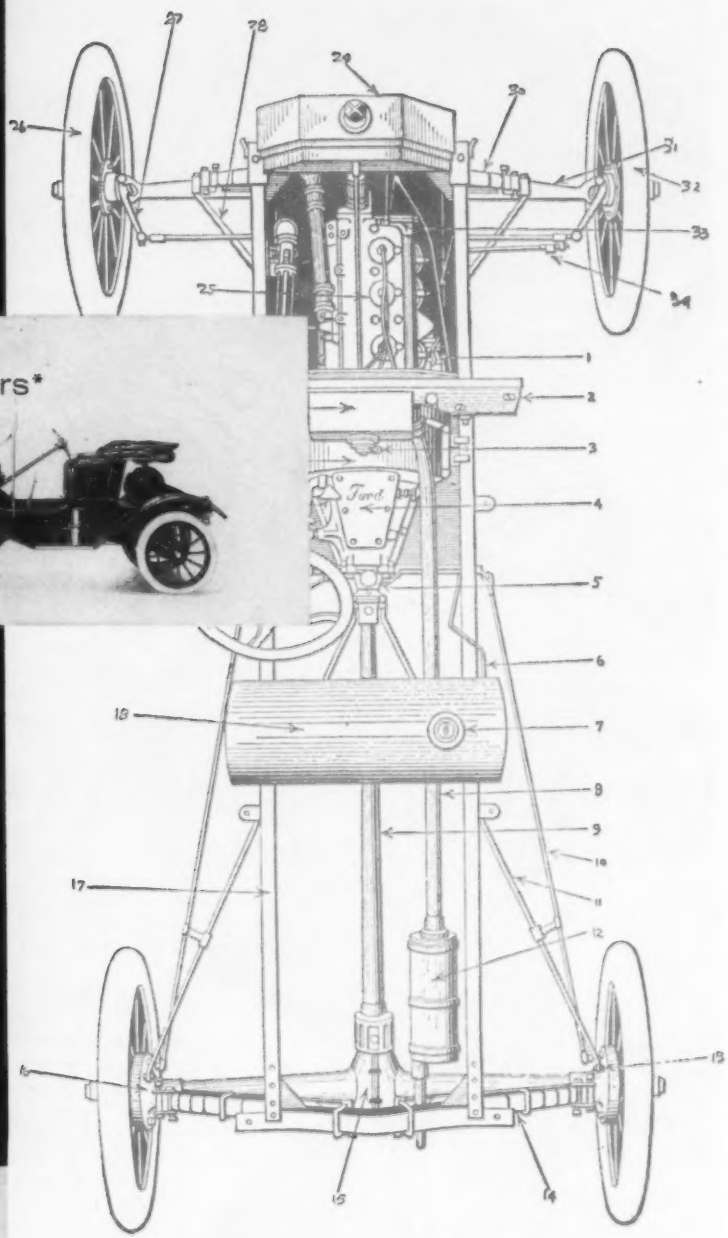


*Sorry, no Jiffy Kit available for Model "T" Ford

Looking for Instant Oil Control?

Install...

AMERICAN HAMMERED

KROME-OIL

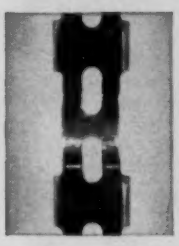
with Stainless Steel Oil Rings

Surveys show what you know—sludging and clogging are the main causes of oil ring failure. Krome-Oil ring sets with stainless steel oil rings resist sludging and clogging. *New* material is the reason.

Stainless steel—the *new* material in Krome-Oil sets—resists the corroding and pitting action of the gases in internal combustion engines (see below). The surface of the stainless steel expander stays clean and unpitted—carbon deposits and varnish build-ups can't get started. The oil vents don't plug.

Stainless steel oil rings are matched with pre-seated, chrome-plated compression rings. Both seat instantly.

Try Krome-Oil on your next job, new or older model, regardless of cylinder condition. Krome-Oil sets don't fail. No comebacks. Try just one set and you'll see.



Typical portion of American Hammered stainless steel oil ring expander after thousands of miles in service. Note how clean and unpitted its surface is. How open the oil vents. Stainless steel resists sludging and clogging—licks the main causes of oil ring failure.

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Automotive Replacement Division
MUSKEGON, MICHIGAN
A Division of Sealed Power Corporation

AMERICAN HAMMERED
PISTON RINGS

BY HERB CARRIER
Detroit Editor

Spokes from the "hub"

• MAIL-ORDER-MOBILE? The showroom may soon give way to the catalog if Montgomery Ward & Company can find the right type of foreign import car to offer for sale. According to Alex M. Richard, Ward's auto supply merchandising manager, "We would be delighted if we could sell between 40,000 and 50,000 cars annually in this country."

Two years ago, the German-built Heinkel was almost added to the store's "For Sale" items. The Heinkel is a one cylinder, 15 horsepower vehicle that resembles the Isetta. It never reached the American marketplace because of a last minute contract received by the factory to build aircraft for the West Germany Air Force.

If Ward's is successful in finding a foreign car that it feels would sell in this country (must retail for less than $1,000), the car probably would not be the kind on which extensive mechanical repairs must be lavished. Richards reports he is looking for a car that "a do-it-yourself addict can maintain with a few tools like a screwdriver and a pair of pliers."

★ ★ ★

No more rusty pipes. The AP Parts Corporation of Toledo, Ohio, manufacturer of automotive replacement exhaust pipes, mufflers, and tailpipes, recently unveiled a rustproofing treatment which is applied to all newly manufactured replacement pipes. Machinery for the rustproofing process is housed in one section of AP's new seventeen-acre plant, completed just a few weeks ago. The rustproofing is especially good news for the service shop that stocks large numbers of replacement pipes in less-than-perfect storage facilities. In many such cases, rust damage can be severe enough to cause a dollar loss: more important, customers seeing a rusty pipe being installed are inclined to feel they are being "taken." AP's contribution should cut down inventory loss—plus keep new parts "new looking."

★ ★ ★

Underseat heater. Ladies suffering from dislocated cold shoulders will pat their cheeks with glee when they hear that Volvo, the Swedish sports car, is now offering genuine sheepskin seat covers for cold weather comfort. According to a Volvo spokesman, the covers fit snugly and can be slipped on or off in a few seconds. May be just the gift to buy the girl who has everything—except a warm spot. Also, could be a good specialty item for the thoughtful parts manager running a business in a neighborhood with a large number of women car-owners.

★ ★ ★

No commercials. Television has been added to Pontiac Motor Division's automotive assembly line. As an extra aid, closed-circuit TV with a 12-inch, 16mm., double-lens camera and 12-inch monitor, helps the man who guides 1959 car bodies unto the chassis at the Pontiac factory. Because the operator can now see both sides of the vehicle at once, the body-to-chassis procedure is much faster than before.

★ ★ ★

Spending tip. Need advice on how to spend money? A. T. Cashel of Sun Electric has a formula by which the owner-operators of medium sized repair shops can gauge the amount of money they should spend for test equipment. According to Cashel, "To determine the amount you can economically spend, take the total number of vehicles and multiply the number of miles driven per year by the average vehicle. Then survey your preventive maintenance program to determine how many preventive maintenance hours will be expended for the total miles traveled. Multiplying the total maintenance hours by 5 cents will tell you how much you can afford for test equipment."

If you are smart enough to figure out the formula, you are certainly smart enough to figure out where to get the money to buy all the equipment the formula calls for.

★ ★ ★

Cool carb. William Broge of Ferndale, Michigan, has announced his invention of a new type of carburetor that reportedly results in enough refrigeration action to keep a normally operating engine 20 to 30 degrees cooler at all speeds. In addition, the carburetor requires no float or float chamber, and no fuel pump. And, there's more—gasoline mileage could be increased as much as 50 to 100 per cent through the use of this new type carburetor, claims its inventor. Other advantages claimed: reduced quantity of unburned gasoline in the engine's exhaust, and elimination of the vapor lock problem.

The carburetor employs a specially designed system for maintaining sufficient vacuum in the carburetor to eliminate the need for a fuel pump. By keying fuel injection to vacuum, the carburetor is said to accomplish much improved fuel distribution. Another most welcome feature—one standardized model can be adapted to fit any popular engine!

Such a carburetor sounds almost too good to be true. Let's hope it isn't just another super-dooper that never gets off the ground. For some reason, **Little Wonder Carburetors** seems to be a basic ingredient of every inventor's Do-It-Yourself Bankruptcy Kit.

★ ★ ★

U. S. Congressional Record of February 2, 1959, tells the story of how Bar's Leaks, a stop-leak product designed specifically for automobile cooling systems, succeeded dramatically in stopping a condenser leak in the atomic powered U.S.S. Nautilus. Rare praise for such a product. Works wonders under pressure caps or Polar Caps!! Congratulations!

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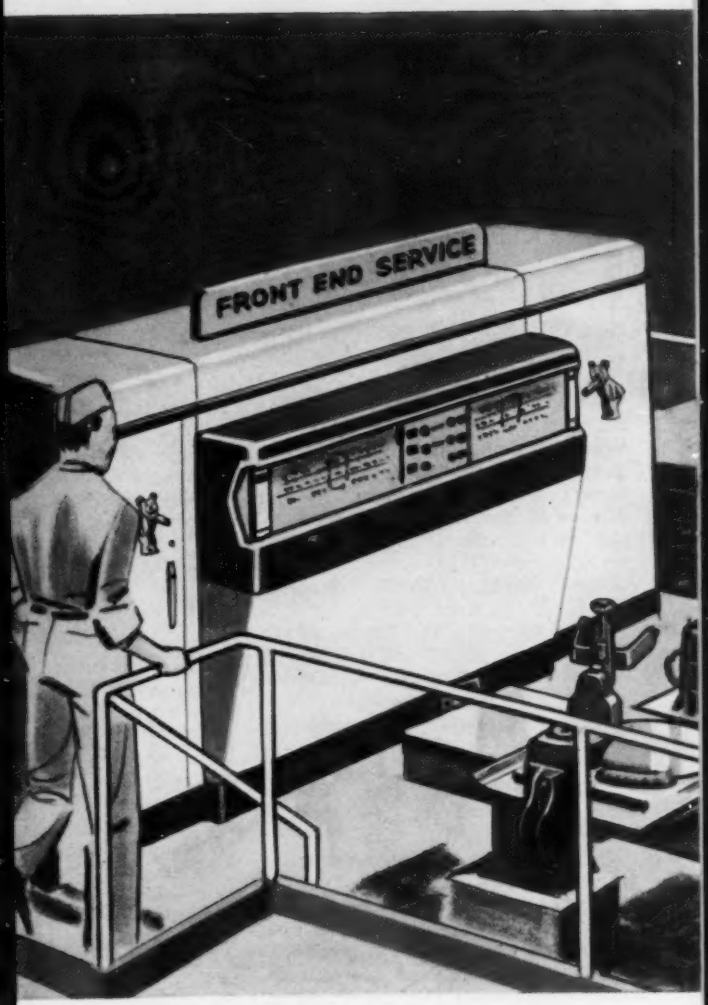

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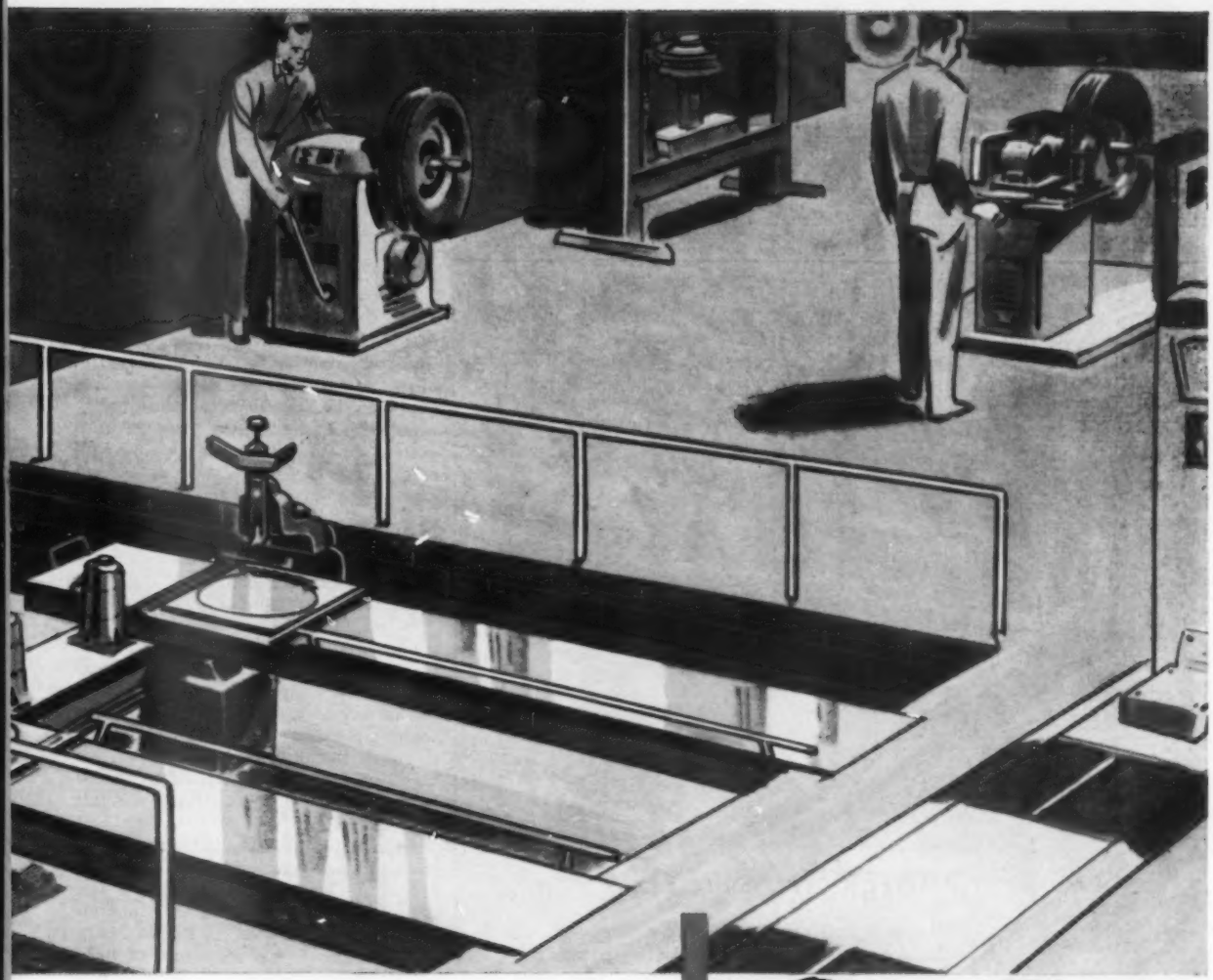
BUILDING
Telaliner®
SERVICE



This precision wheel alinement and front-end correction service has undoubtedly made more money, for more shops, than any piece of safety service equipment ever designed! And, the famous Telaliner is only one of a complete line of over 50 major pieces of service equipment and tools you'll see *in action* in the new, *free Bear Profit Idea Book*... a husky, full-color book brimming with proven profit ideas... page after page of the most modern advancements in alinement, balancing, body-frame, and safety testing equipment... shown in a wealth of business-building shop layout ideas.

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Automotive Clinic . . .

(Continued from page 6)

p.s.i. with oil approximating warm 10W there is a continuous shower of oil seemingly concentrated at the main bearing caps. There is considerable flow even at pressures as low as 10 p.s.i. Poor visibility, however, makes it impossible to determine the exact source of this leakage.

In desperation we bought a set of semi-finished main bearings and had them line bored to a vertical clearance of .0015" and at the same time installed another set of rod bearings. A little improvement was noted.

Any helpful suggestions you can pass on will be sincerely appreciated. *G.T.H., Henderson, N.C.*

Answer: Oil pressure depends on several factors: (1) The amount of oil that can get through the bearings; (2) The amount of oil and the pressure developed by the pump; (3) Possible source of oil leakage, other than past bearings, and (4) The oil pressure relief valve.

On a car that has gone 85,000 miles it could be that the oil pump is worn to the extent that it will not put out enough volume at the required pressure, but you say this has been replaced.

Another thing . . . do you actually have the recommended main bearing clearance of .0015". If these dimensions are correct, there should not be more than the normal flow of oil through the bearings. Check all the oil lines and passages for possible leaks or by-passes. Check the pressure relief valve and spring. Check the oil pressure gauge, to be sure you are getting the correct indications on it.

The fact that the engine runs perfect, as you say, with no knocks or rattles, would seem to indicate that the trouble cannot be very serious.

Is the engine losing oil or burning oil? If it is not burning oil, it would seem to indicate that the amount passing the bearings is not excessive.

In regard to the allowable amount of oil flowing when the leak detector is used, there are so many variables involved, such as the oil viscosity, the oil temperature, the leak detector pressure, the grade of oil, the quality of oil, etc. It should not come out in a stream or shower, unless the bearing clearance is excessive.

Hydra-Matic Fluid Level

We are having trouble checking the fluid level in the Hydra-Matic of a 1954 Nash Ambassador.

When this car first came into our shop it had been leaking fluid at both front and rear seals. To give it a good test before overhauling it, we drove the car for several miles to thoroughly warm up the transmission, then tried to check the fluid level. However, we were unable to tell where the fluid level was because the fluid was all over the stick.

After overhauling the transmission the leaks are gone and the unit works fine, but—we still can't tell by the stick where the oil level is (fluid all over the stick). We do know, however, that the proper amount of fluid is in the transmission. What's our trouble- *W.C.M., Prescott, Ariz.*

Answer: To check the fluid level in this Hydra-Matic, have the selector lever in "N" or "P" and run the engine at a speed corresponding to 20 m.p.h. for approximately 1½-2 minutes. Stop the engine and observe the level on the dip stick. If necessary, remove the dip stick, wipe it off, and put it in again to get the fluid on it; then withdraw it and observe the level. The fluid should be ¼" below the "Full" mark when cold, and right at the mark when hot.

If you check the level with the engine not running, you will have no trouble determining where the level is. The level should be checked only after the engine has been running so that the fluid coupling will be full.

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No Oil Through Push Rods

The problem encountered is with a 1955 Chevrolet V8 with standard transmission and overdrive. The trouble is with the lubrication of the overhead valve mechanism, on the left cylinder bank.

There is oil at the last two push rods, but the remaining six rods of this bank do not pass any oil at all through them, even at higher engine speed.

I do not believe this is due to oil pump trouble or a clogged oil filter screen. I'm inclined to believe the hollow push rods are clogged with sludge, since the right bank gets plenty of oil.

Will some type of solvent or cleaner help and do you recommend kerosene for the remedy.—*H.C., Los Angeles, Calif.*

Answer: If all except three of the rocker arms are getting adequate lubrication it is evident that some oil passages are clogged. One way to open the passages is to remove the push rods and clean them out.

A powerful solvent that can be used is butyl cello-solve. Use 8 ounces of this, 1 quart of lubricating oil and 4 quarts of kerosene. Drain out the engine oil, replace with butyl cello-solve mixture. Run the engine for an hour or so at idle speed, out-of-doors. Drain and replace with engine oil. This treatment has been used successfully to free up stuck hydraulic valve lifters and should also clean out clogged oil passages.

You can get butyl cello-solve at chemical supply houses.

Won't Start When Hot

In recent months I have read with interest the many "hard starting when hot" questions sent in by your readers, and figured I was pretty well versed on this subject. However, I have an eight-cylinder, 1952 Pontiac in my shop which has tried my patience. The trouble is, the engine starts right off when cold and runs fine until it warms up and you turn off the ignition. Try to start it and nothing will happen, not until it has cooled off.

In my efforts to lick this problem, I have done the following: Installed new spark plugs; overhauled distributor (new points, condenser, breaker plate, coil, rotor, etc.,); overhauled carburetor; checked manifolding for leaks; made compression and vacuum check (both good); installed new timing chain; adjusted valves .002" more than standard; substituted a new battery with new battery cables; checked all wiring connections for looseness and resistance; changed starting motor and solenoid; put a spark booster in the distributor cap and ran two quarts of solvent through the engine.

Would appreciate any suggestion from you that might clear up this situation. *A.E.S., Salt Lake City, Utah.*

Answer: Considering all the things you have done to this powerplant, it should start easily when hot. One point we notice, however: You apparently have overlooked the coil. Why don't you try another coil that is known to be good. Sometimes a coil will short out some turns when it gets hot.

You say compression "is good all the way across," but you do not give any figures. We suggest a cylinder leakage test, as this may be quite revealing.

You made a mistake in setting the valves .002" more than specified, as this will throw off the valve timing and make the valves noisy. You do not give any figures on circuit resistances—none of which should be over .1 volt.

Have you checked the heat riser to see that it is working? How about the automatic choke? Have you observed its action when the engine is hot? What is the dwell . . . ignition timing . . . vacuum advance . . . fuel pump pressure and delivery . . . voltage at coil (battery side)? These, too, are points you should look into.

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Editor's page

Tying-in with the trends

• ALONG WITH BEING a huge, spectacular affair, the International Automotive Service Industries Show at Chicago last month was a thought provoker. Of the great numbers of shop operators who attended, many returned to their places of business reassured about their present practices—but with an eye to the future as well. Such an exhibit of servicing gear and know-how makes one stop and think. And well it may!

Four hundred fifty or so manufacturer exhibits of countless new development and service methods—many by "live demonstration"—are bound to leave lingering impressions . . . possibly even concern. This is the case at least with shop owners who think of the future and of keeping pace with their ever-changing industry.

The Service Show's vast assemblage of new equipment, processes and approaches for reducing the time factor by simplifying service procedures, and thus meeting the situation that arises from ever-mounting car registrations, commands profound respect. Many shopmen who attended probably came away pondering about the adequacy of their present facilities to cope with more exacting precision demands, and the stepped-up pace of the modern service work that is to come.

Tying-in with the trends may be the very way of staying in the modern service business.

As new chassis and bodies with unorthodox units change previous conceptions of the motor car, so will the facade of automotive service change.

As good today as when first coined years ago, is the old bromide: "The best equipped shop gets the business." Shop equipment makers are keeping pace with the trends—Service Show visitors will attest to this! If the Show served no other purpose, it reminded shop owners—forcibly—that a re-evaluation of their present set-ups is in order if a profitable business is to continue into the future.

Ben Ikert
EDITOR

The Ford four-barrel carburetor

Carburetor work requires familiarity with the five lines currently used on domestic cars—each car manufacturer using two or more interchangeably as a matter of policy. Here's the inside story on the four-barrel carburetors used in the 1959 Ford line . . . the dependable hearts of its fuel system.

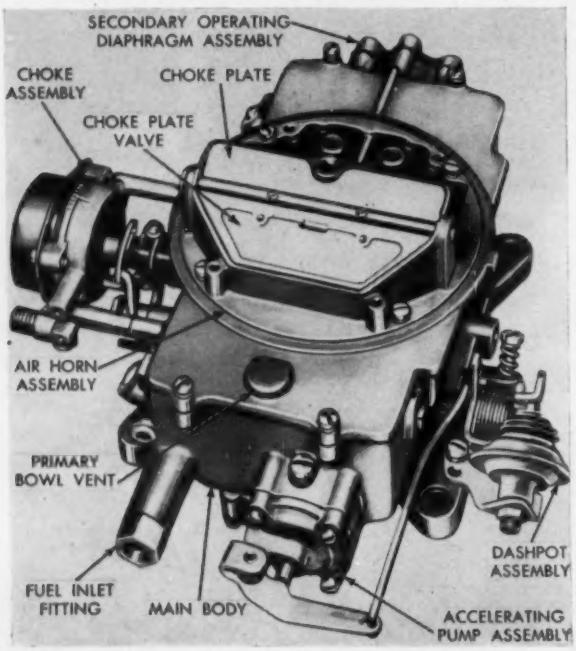
• TWO DIFFERENT FOUR-BARREL carburetors are used on the Ford Motor Co's. 1959 passenger cars. On Ford models the new four-barrel Ford carburetor is used; the Thunderbird uses either the Carter AFB carburetor (described in the January, 1959 issue of ASD) or the Ford carburetor. Edsels are equipped with the Ford carburetor, Lincolns with the Carter AFB.

The Ford carburetor, being a relatively new item, may not be quite as well known to the trade as the Holley, which is still used in the one- and two-barrel models. However, the four-barrel Ford Carburetor will appear in sufficient numbers to make it well worth while for mechanics to fully understand its operation.

TWO MAIN ASSEMBLIES

The Ford carburetor consists of two main assemblies, the air horn and the main body. Figs. 1, 2 and 3, with important parts indicated, show the general arrangement. The air horn assembly which serves as the main bowl cover, contains the choke plate or choke valve and the primary fuel bowl vent.

Fig. 1. Ford four-barrel carburetor featuring a two-barrel (primary) plus two auxiliary barrels (secondary).



For all practical purposes the four-barrel carburetor may be considered as the equivalent of a two-barrel (primary) carburetor on which the engine operates most of the time plus two auxiliary barrels (secondary). The latter only go into action when more fuel is needed than can be supplied by the primary portion, due to heavy load, rapid acceleration or very high speed. On most four-barrel carburetors the two primary barrels are in front and the secondary barrels in the rear of the unit.

The Ford carburetor main body houses the primary and secondary throttle plates or throttle valves, accelerating pump assembly, power valve assembly, secondary operating diaphragm assembly, and the fuel bowls. The automatic choke housing is attached to the main body.

The two primary barrels each contain a main and a booster venturi, main fuel discharge, accelerating pump discharge, idle fuel discharge, and the primary throttle plate. The small booster venturi is located just above and on the same center line with the main venturi, and is used to augment the vacuum formed by the velocity of the air passing through the throat of the main venturi.

FOUR BASIC METERING SYSTEMS

The carburetor has a primary fuel circuit, and a vacuum operated secondary fuel circuit. The primary circuit has four basic fuel metering systems: (1) the idle system, (2) the accelerating system, (3) the main fuel system (called the high speed system or the part throttle system by some carburetor makers) and (4) the power system. A fuel inlet system for both the primary and secondary circuits provides the various fuel metering systems with a constant supply of fuel. In addition, an automatic choke system provides a means of temporarily enriching the mixture to aid in starting and operating a cold engine.

The vacuum below the throttle plate and that at the

By GUY F. WETZEL
Technical Editor

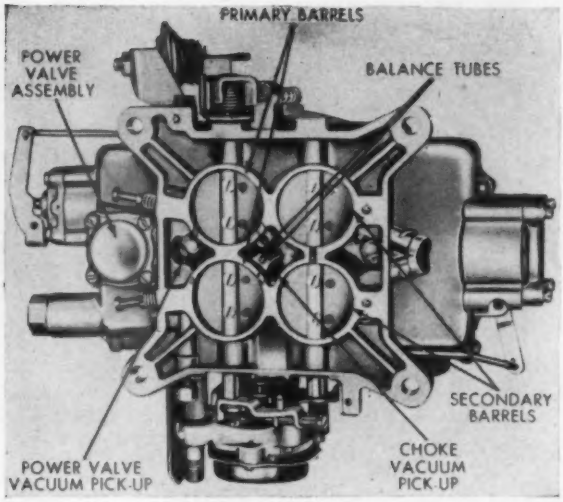


Fig. 2. Bottom view of the four-barrel carburetor showing location of primary barrels and secondary (auxiliary) barrels.

venturi cause the proper fuel discharge for various engine speed and load conditions. Actually the "vacuum" is difference in air pressures which causes liquid fuel to flow from an area of higher pressure to one of lower pressure.

There are separate fuel bowls for the primary and secondary fuel systems (Fig. 4). Each bowl contains a float assembly and a fuel inlet needle and seat assembly. The fuel first enters the primary fuel bowl through the fuel inlet fitting and screen assembly. A drilled passage through the right side of the main body connects the fuel bowls. The pressures in the two fuel bowls are balanced by a pressure equalizing chamber built in the left side of the main body.

The amount of fuel entering either bowl is determined by the distance the fuel inlet needle is raised off its seat and by fuel pump pressure. The extent to which the needle valve opens depends on the level of the float in the fuel bowl. As the level drops the float lowers and the fuel inlet needle rises to allow more fuel to enter the bowl. When the fuel reaches the predetermined level, the float lowers the needle valve, restricting the flow of fuel to that flowing out through the metering systems.

It is important that the correct fuel level be maintained because the carburetor is calibrated to deliver the correct air-fuel mixture only when the fuel is at the prescribed level. A retracting clip is attached to the fuel inlet needle and hooks over the tab on the float assembly. This clip assures reaction of the fuel inlet needle to any movement of the float. The primary fuel bowl is vented externally at all times.

AUTOMATIC CHOKE SYSTEM

When a cold engine is being started, much of the fuel is not vaporized until sufficient heat is developed in the intake manifold to allow vaporization and maintain a uniform air-fuel mixture for good combustion. Because of this condition a much larger quantity of fuel must be supplied on cold starting to initiate combustion.

The choke plate, or valve, located in the air horn above the primary venturies, provides a high vacuum above as well as below the throttle plates, when closed. With sufficient vacuum above the throttle plates, fuel will flow from the main fuel system as well as from the idle system. This causes the fuel mixture to become sufficiently rich for cold engine operation.

The carburetor choke valve shaft is linked to a thermostatic choke control mechanism mounted on the body (Fig. 5). The bi-metal thermostatic spring in the choke housing mechanism unwinds when cold, winds up when warm. With a cold engine, the thermostatic spring holds the choke plate in a closed position through the attaching linkage. As the engine starts, enough air is drawn through the spring loaded choke plate valve to allow engine operation without flooding.

AIR HEATED BY EXHAUST MANIFOLD

As the engine continues to run, manifold vacuum, channeled through a passage on the bottom of the main body to the choke housing, draws heated air from the exhaust manifold heat chamber. The amount of air entering the choke housing is controlled by restrictions in the air passages in the carburetor.

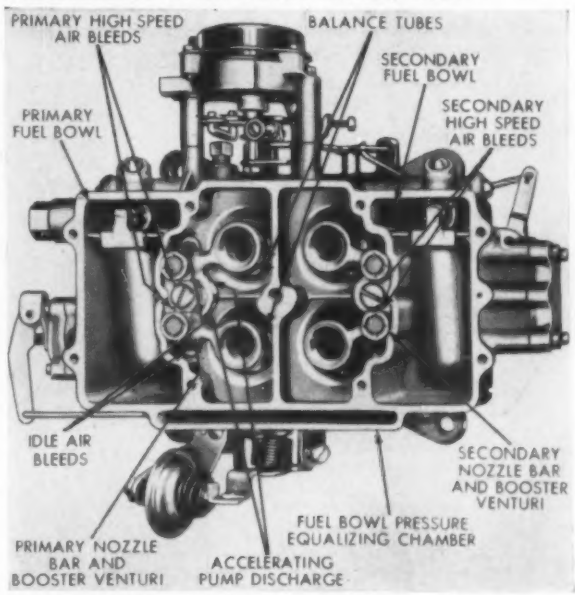
The thermostatic spring is heated by the warm air which enters the choke housing, causing it to wind up. The tension of the thermostatic spring gradually decreases as the temperature of the air from the heat chamber rises, allowing the choke plate to open all the way. The warmed air is exhausted into the intake manifold.

When the engine reaches its normal operating temperature, the spring no longer exerts an opposing tension on the choke plate, so that the air velocity acting on the offset choke plate, as well as the manifold vacuum acting below the plate, forces it to the full open position. A baffle plate, located in the choke housing, controls the rapidity with which the temperature rises in the thermostatic spring housing. Small holes in the plate pass the heated air directly onto the thermostatic spring at low temperatures when the choke plate is closed.

As the temperature rises and the choke plate opens, the baffle plate moves and the heated air is directed onto the spring by an alternate route which slows up the rate of temperature rise. When the spring allows the choke plate to be fully opened, the heated air is passed directly onto the spring and out of the choke housing by the shortest route. This arrangement keeps the thermostatic spring heated so that the choke plate remains fully open until the engine is stopped and allowed to cool.

(Continued on following page)

Fig. 3. Top view of four-barrel carburetor which has a primary fuel circuit and a vacuum operated secondary circuit.


PRIMARY HIGH SPEED AIR BLEEDS
BALANCE TUBES
SECONDARY FUEL BOWL
PRIMARY FUEL BOWL
SECONDARY HIGH SPEED AIR BLEEDS
IDLE AIR BLEEDS
SECONDARY NOZZLE BAR AND BOOSTER VENTURI
FUEL BOWL PRESSURE EQUALIZING CHAMBER
PRIMARY NOZZLE BAR AND BOOSTER VENTURI
ACCELERATING PUMP DISCHARGE

FAST IDLE CAM

The fast idle cam pick-up lever actuates the fast idle cam during the choking period. Steps on one edge of the fast idle cam contact the fast idle adjusting screw, permitting faster engine speed (for smoother running while the engine is cold). As the choke plate is moved through its range of travel from the closed to the open position, the pick-up lever rotates the fast idle cam so that it holds the throttle slightly open. Each step on the fast idle cam permits a slower idle r.p.m. as engine temperature gradually rises and the amount of choking is reduced.

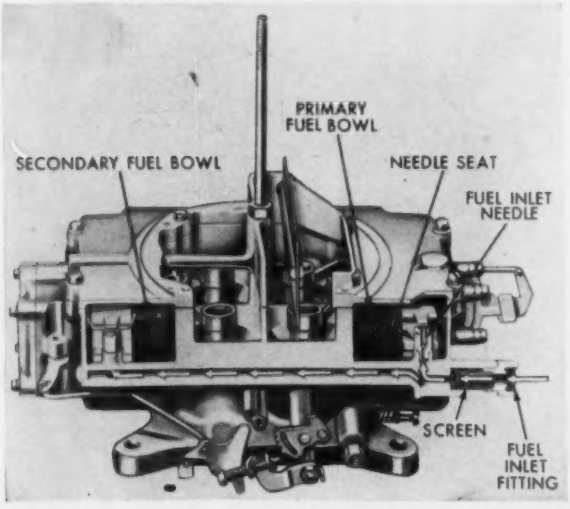
During the warm-up period, if the engine should reach the stall point due to too lean a mixture for the engine temperature, manifold vacuum will drop considerably. When this happens, the tension of the thermostatic spring then overcomes the action of the lowered vacuum and air velocity acting on the choke plate. The choke plate will swing toward the closed position, temporarily providing a richer mixture to prevent stalling. The linkage between the choke lever and the throttle shaft is designed so the choke plate will partially open when the accelerator pedal is fully depressed. This permits unloading and purging of a flooded engine.

IDLE FUEL SYSTEM

When operating at idle and low speed, the engine does not draw sufficient air through the primary venturi to create sufficient vacuum to operate the primary circuit main fuel system (or high speed circuit). Air velocity through the venturi causes sufficient vacuum at the venturi throat to draw the fuel through the main fuel metering jets. If there is not enough air flowing, as is the case at idle, the venturi is ineffective. Therefore, an idle fuel system must be provided, which does not depend on venturi vacuum, to supply fuel at idle and low speed. At this time, intake manifold vacuum is high, and this vacuum provides the needed pressure differential to operate the idle fuel system.

Fuel for idling is discharged into both the primary and secondary barrels. Idling fuel for the primary barrel is drawn from the primary fuel bowl. For the secondary barrels, idling fuel is drawn from the secondary fuel bowl. This differs from the Carter AFB four-barrel carburetor previously described in which there is no idle fuel supply in the secondary barrels.

Fig. 4. Fuel inlet system. Pressures in the two bowls are balanced by a pressure equalizing chamber.



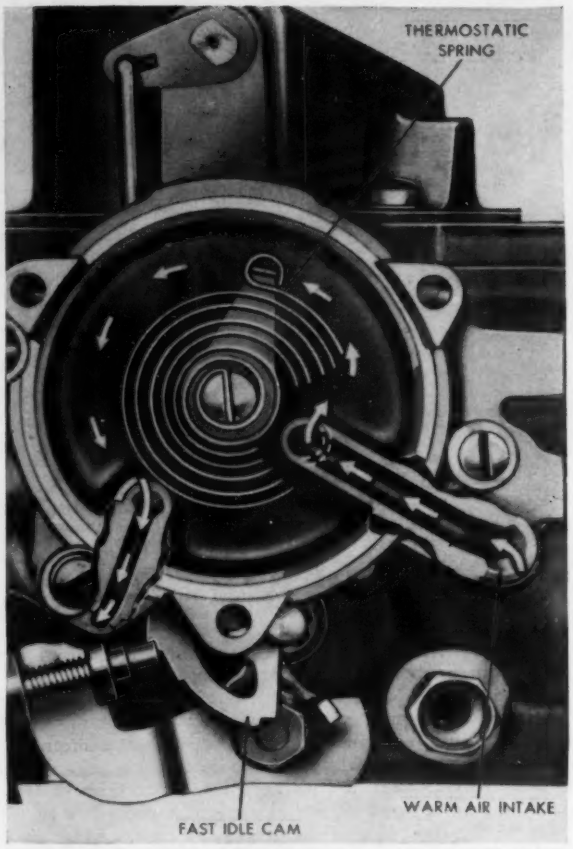


Fig. 5. Automatic choke system. The choke valve shaft is linked to a thermostatic control mechanism mounted on the body.

In the Ford carburetor, the two primary barrels have identical fuel systems, and those in the two secondary barrels are also alike. At idle speed, the normal air pressure in the fuel bowls causes fuel to flow through the idle system passages to the space below the throttle plates, where the air pressure, due to vacuum, is lower. Fuel will always flow from higher to lower pressure, provided the pressure difference is greater than the liquid pressure due to height (hydrostatic pressure). Fuel flows from the fuel bowls through the main jet and into the bottom of the main well.

From the main well the fuel flows up through the idle tube and through a short diagonal passage in the nozzle bar and booster venturi assembly into the idle passage in the main body. A calibrated restriction at the upper tip of the idle tube meters the fuel flow.

PRIMARY CIRCUIT

An idle air bleed, located directly above the idle tube, introduces air into the primary idle fuel system. The air bleed also acts as a vent to prevent siphoning in the idle fuel system at off-idle or high speeds and when the engine is stopped. Additional air is bled into the system through an air bleed in the nozzle bar where the fuel enters the idle passage in the main body.

Fuel flows down the idle passage in the main body past two idle transfer holes. These holes act as additional air bleeds at curb idle. The fuel then flows past the pointed tip of the adjusting needle, which controls the idle fuel discharge in the primary circuit. From the adjusting needle chamber the fuel flows through a short

horizontal passage and is discharged below the primary throttle plates.

During off idle, when the primary throttle plate is moved slightly past the idle transfer holes, each hole begins discharging fuel as it is exposed to manifold vacuum. As the primary throttle plate is opened still wider and engine speed increases, the air flow through the carburetor is also increased. This reaches a point in volume sufficient to cause venturi vacuum strong enough to bring the main (high speed) fuel system into operation, and it begins to discharge fuel.

SECONDARY CIRCUIT

Air is introduced into the secondary circuit idle fuel system from an idle air bleed which is located directly above the idle tube. This air bleed also acts as a vent to prevent siphoning in the idle fuel system at high speeds and when the engine is stopped. The action is the same as the corresponding air bleed in the primary idle

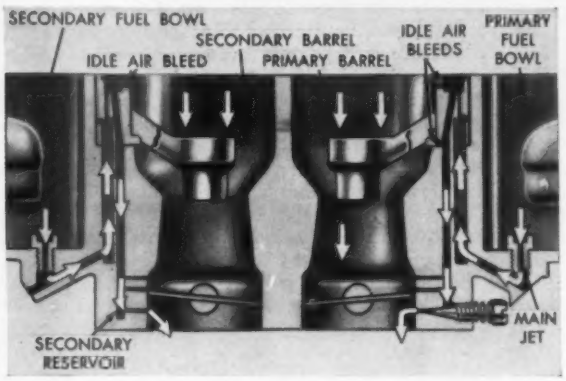


Fig. 6. Idle fuel system. Fuel for idling is discharged into both the primary and secondary barrels.

system. Fuel flows down the idle passage in the main body past two transition holes above the closed throttle plate and flows through a metered restriction into a short horizontal passage, being discharged into the secondary barrel below the closed throttle plate. The transition holes act as air bleeds at idle. The secondary idle system continues to discharge fuel until the secondary main fuel system comes into operation.

ACCELERATING SYSTEM

When the throttle is opened for acceleration, the air flow through the carburetor responds almost immediately to the change in throttle opening. However, there is a brief interval before the fuel, which is heavier than air, can pick up speed equivalent to the speed of the air. During this interval, the accelerating system supplies the additional fuel needed to maintain the correct mixture, after which the other systems again supply the desired air-fuel mixture (Fig. 7).

Notice on this carburetor that the accelerating pump is of the diaphragm type, rather than the plunger type widely used in the past. When the throttle is closed, the diaphragm return spring forces the diaphragm toward the cover, drawing fuel into the chamber through the inlet. The inlet has a ball check which opens to admit the fuel and closes when the pump is operated, to prevent reverse flow. A discharge ball check prevents air from entering when fuel is drawn into the chamber.

When the throttle is opened the diphragm rod is forced inward, forcing fuel from the chamber into the discharge passage, from which it is sprayed into each primary

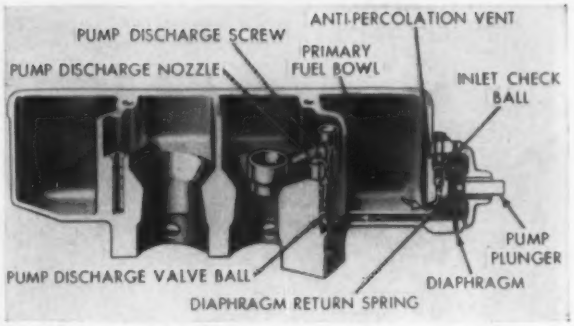


Fig. 7. Accelerating system. The pump is of the diaphragm type, rather than the plunger type, heretofore widely used.

booster venturi through the discharge ports in the nozzle bar assembly.

PRIMARY MAIN FUEL SYSTEM

As engine speed increases from idling, the air passing through the venturi creates a vacuum at the venturi throat. The amount of vacuum is proportional to the amount of air flowing, and this in turn is determined by the amount of throttle opening. What we call "vacuum" is actually only depressed air pressure or a pressure difference between the atmospheric pressure and some degree of vacuum at certain points or areas. This difference in pressure between the air on top of the fuel in the float bowl and the air at the throat of the venturi causes fuel to flow through the main fuel system approximately in proportion to throttle opening.

At a predetermined minimum venturi vacuum, fuel starts to flow from the primary fuel bowl, through the main jets and into the bottom of the main well. The fuel moves up the main well tube, past the air bleed holes.

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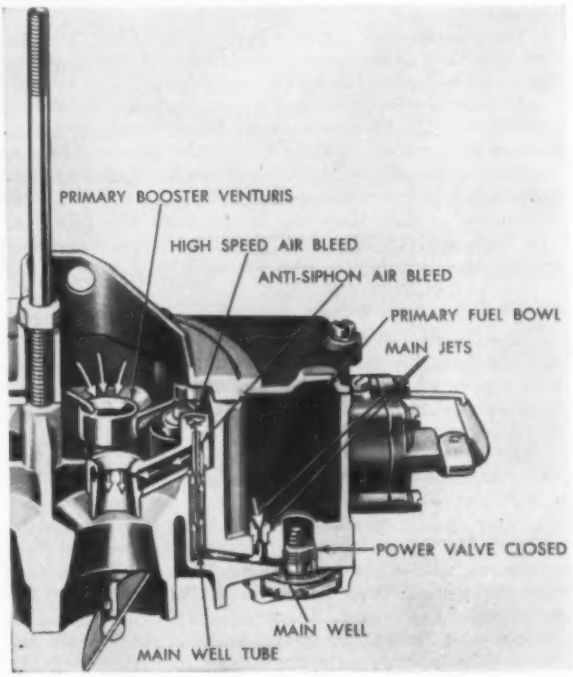
Fig. 8. Primary main fuel system. The high speed air bleed meters more air to the fuel as the venturi vacuum increases to maintain proper air fuel ratio.



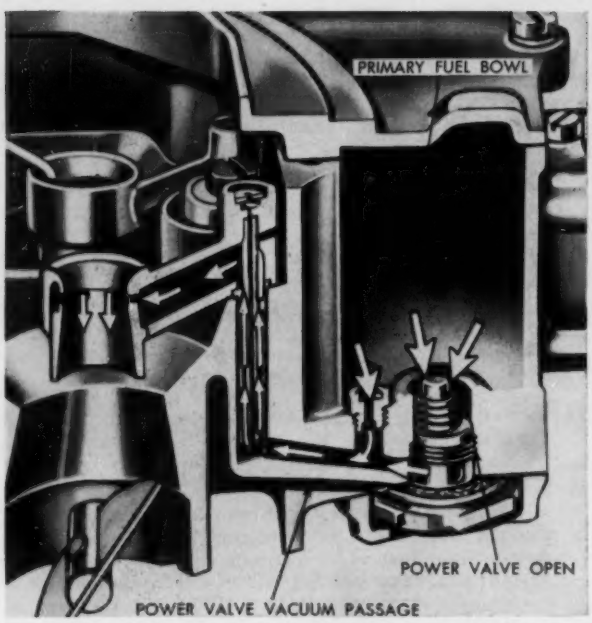


Fig. 9. Power fuel system, which supplies extra fuel to slightly enrich the mixture for load and speed conditions.

Filtered air from the high speed air bleed enters the fuel flow in the main well tube through holes in the side of the tube. The high speed air bleed meters an increasing amount of air to the fuel as the venturi vacuum increases, maintaining the desired air-fuel ratio. The mixture of fuel and air is lighter than the raw fuel and responds faster to changes in venturi vacuum. It also vaporizes more readily than raw fuel. The fuel and air continue up the main well tube past another airbleed, which also acts as a vent to prevent siphoning when the engine is stopped. The fuel is discharged into the booster venturi where it is vaporized and mixed with the air flowing through the carburetor.

The throttle plate controls the amount of fuel-air mixture admitted to the intake manifold, and this regulates the speed and power output of the engine.

A balance tube is located in each primary barrel directly below the booster venturi. When decelerating, the balance tube siphons off any excess fuel droplets remaining around the edge of the booster venturi and discharges these droplets into the equalizing slots in the base of the carburetor, where they are mixed with the idle fuel. The balance tube also acts as an additional air bleed during operation of the idle system.

POWER FUEL SYSTEM

This is sometimes referred to as the "full power system" or "power enrichment system" (Fig. 9). Its purpose is to supply additional fuel to slightly enrich the air-fuel mixture during periods of increased road loads or high speed operation.

The power fuel system is controlled by intake manifold vacuum, which gives an accurate indication of the power demands placed on the engine. Manifold vacuum is highest at idle speed and decreases as the load on the engine is increased. Manifold vacuum is transmitted from an opening in the base of the main body, through a passage in the main body and power valve chamber to the power valve diaphragm. The manifold vacuum, acting on the power valve at idle speed, is sufficient to hold the power valve diaphragm down, overcoming the tension of the spring on the valve stem, keeping the valve closed. When high power operation places a greater load on the engine, and intake manifold vacuum drops below a predetermined value, the spring opens the power valve. This allows fuel from the primary bowl to flow through the power valve and into the passages leading to both primary circuit main fuel wells. Here the fuel is added to the fuel from the primary circuit main fuel system, enriching the mixture.

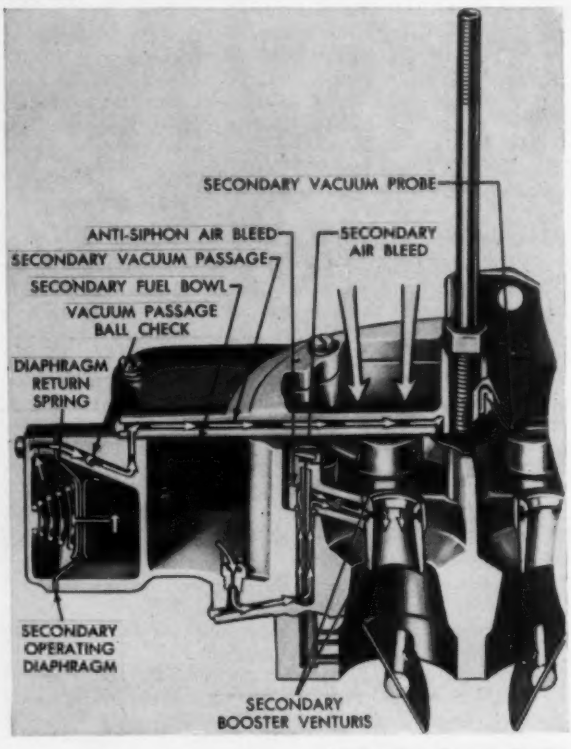
When and as engine demands are reduced, manifold vacuum increases and overcomes the tensions on the power valve spring, and the valve closes. Thus the extra fuel for power requirements is available when needed, but is supplied only when needed.

SECONDARY MAIN FUEL SYSTEM

The secondary main fuel system is inoperative during moderate speed driving or moderate engine loads. However, when the power demands on the engine become greater than can be met by the primary fuel supply, additional fuel-air mixture is supplied by the secondary circuit, as illustrated in Fig. 10. The additional supply of fuel-air mixture is delivered through the two secondary (rear) barrels of the carburetor. The secondary circuit throttle plates are operated by a spring-loaded vacuum diaphragm assembly attached to the main body and linked to the secondary throttle shaft.

Opening of the secondary throttle plates is controlled by vacuum from one primary booster venturi. A vacuum pick-up tube (or probe) extends into the left primary booster venturi. The vacuum is transmitted through this tube to a passage through the air horn, main body, and behind the secondary operating diaphragm. As the primary throttle plates are opened, primary venturi vacuum increases due to greater air flow through the venturi. When the vacuum reaches a pre-determined value, it

Fig. 10. Secondary stage operation. Power demands greater than those provided by the primary fuel supply are cared for by the secondary.



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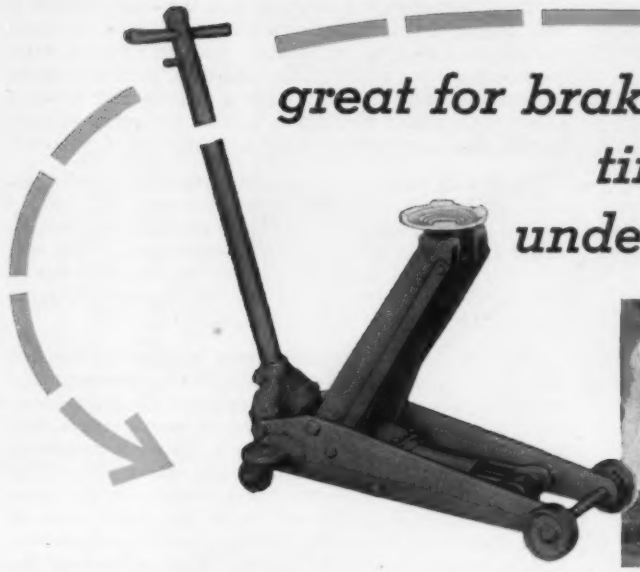

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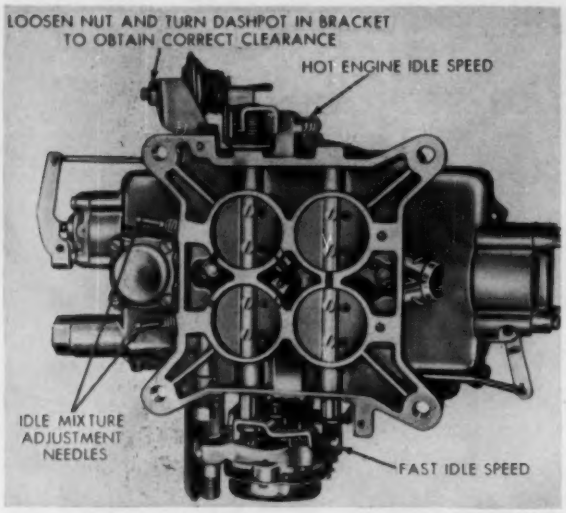
LOOSEN NUT AND TURN DASHPOT IN BRACKET TO OBTAIN CORRECT CLEARANCE
HOT ENGINE IDLE SPEED
IDLE MIXTURE ADJUSTMENT NEEDLES
FAST IDLE SPEED

Fig. 11. Bottom view of carburetor showing the on-the-car adjustments. Idle speed adjustments are made at from 450 to 475 engine r.p.m.'s.

starts to act on the secondary circuit operating diaphragm, which in turn starts to open the secondary throttle plates.

As the secondary throttle plates begin to open, fuel flows from the secondary fuel bowl through the secondary main jets into the bottom of the main well and up the main well tube, past air bleed holes. Air is introduced through an air bleed at the top of the tube. When the secondary throttle plates are moved slightly past the secondary transition holes, each hole begins discharging fuel as it is exposed to manifold vacuum. As secondary venturi vacuum is increased the fuel is discharged into the secondary booster venturi. Fuel from the transition holes tapers off and the holes act as additional air bleeds.

On deceleration, vacuum in the primary venturi decreases, and the secondary throttle shaft (coupled to the throttle lever) will mechanically overcome any lag in the vacuum system, closing the secondary plates, and thereby assuring rapid and positive engine deceleration.

ON-THE-CAR ADJUSTMENTS

Hot engine idle speed is adjusted by the left side throttle stop screw (Fig. 11). Set the engine idle speed in drive range. Set the hand brake and place selector lever in drive range. Check engine idle speed and adjust to the drive range specifications, which call for 450 to 475 r.p.m. The final engine idle speed may be varied to suit the conditions under which the car is to be operated. After the hot engine idle speed has been adjusted, adjust the fast idle speed.

Fast idle (cold) engine idle speed is adjusted by the adjusting screw on the right side of the carburetor, which contacts the steps on the fast idle cam (Fig. 11). With engine at normal operating temperature, adjust hot engine speed to desired r.p.m. before setting fast idle speed.

With fast idle cam in the low position (bottom step on the fast idle cam) turn the fast idle speed adjusting screw in until it just touches the lowest steps on the fast idle cam, then back it off ¼ to ½ turn.

Idle mixture adjustment is controlled by the idle mixture adjusting needles. The needles are turned in to lean the mixture, and out to enrich it. To make the initial adjustment, turn the needles in until they contact the seats lightly, then back off 1 to 1½ turns. The engine must be operated until its temperature has become stabilized.

Turn the mixture needles in until the engine starts to run roughly from the lean mixture, then turn out until the engine begins to "roll" from the rich mixture. Turn the needles in very slowly, one at a time, until the engine operates smoothly. Always favor a slightly rich mixture rather than a lean mixture. It may be necessary to reset engine idle speed after correct idle mixture is obtained.

Anti-stall dashpot adjustment is made after the engine idle speed is adjusted. Loosen the anti-stall dashpot locknut, hold the throttle in closed position, depress the anti-stall dashpot plunger with a screwdriver blade, and turn the anti-stall dashpot in its bracket in a direction to provide the specified clearance of .035″ to .050″. Tighten the locknut to secure the adjustment.

The automatic choke adjustment controls its reaction to engine temperature. By loosening the three screws that retain the thermostatic spring housing to the choke housing, the spring housing can be turned in a counterclockwise direction which will require a higher thermostatic spring temperature to fully open the choke plate (Fig. 12). Turning the thermostatic spring housing in the opposite direction (clockwise) will cause the choke plates to fully open at a lower thermostatic spring temperature. This is the lean direction indicated by the arrows on the cover. Correct adjustment will be very close to the mid-position mark as indicated by the divisions on the choke housing. This setting should not be over 2 divisions on either side of the mid-position mark.

After overhauling the carburetor, the float should be adjusted, using the cardboard gauge furnished in the carburetor overhaul repair kit. The fast idle cam and bellcrank lever should be adjusted. With the choke plate fully closed, set the bellcrank lever so that the fast idle adjusting screw seats on the next to the highest step on the fast idle cam.

Fig. 12. Automatic choke adjustment is accomplished by first loosening the three screws retaining the spring housing to the choke housing.

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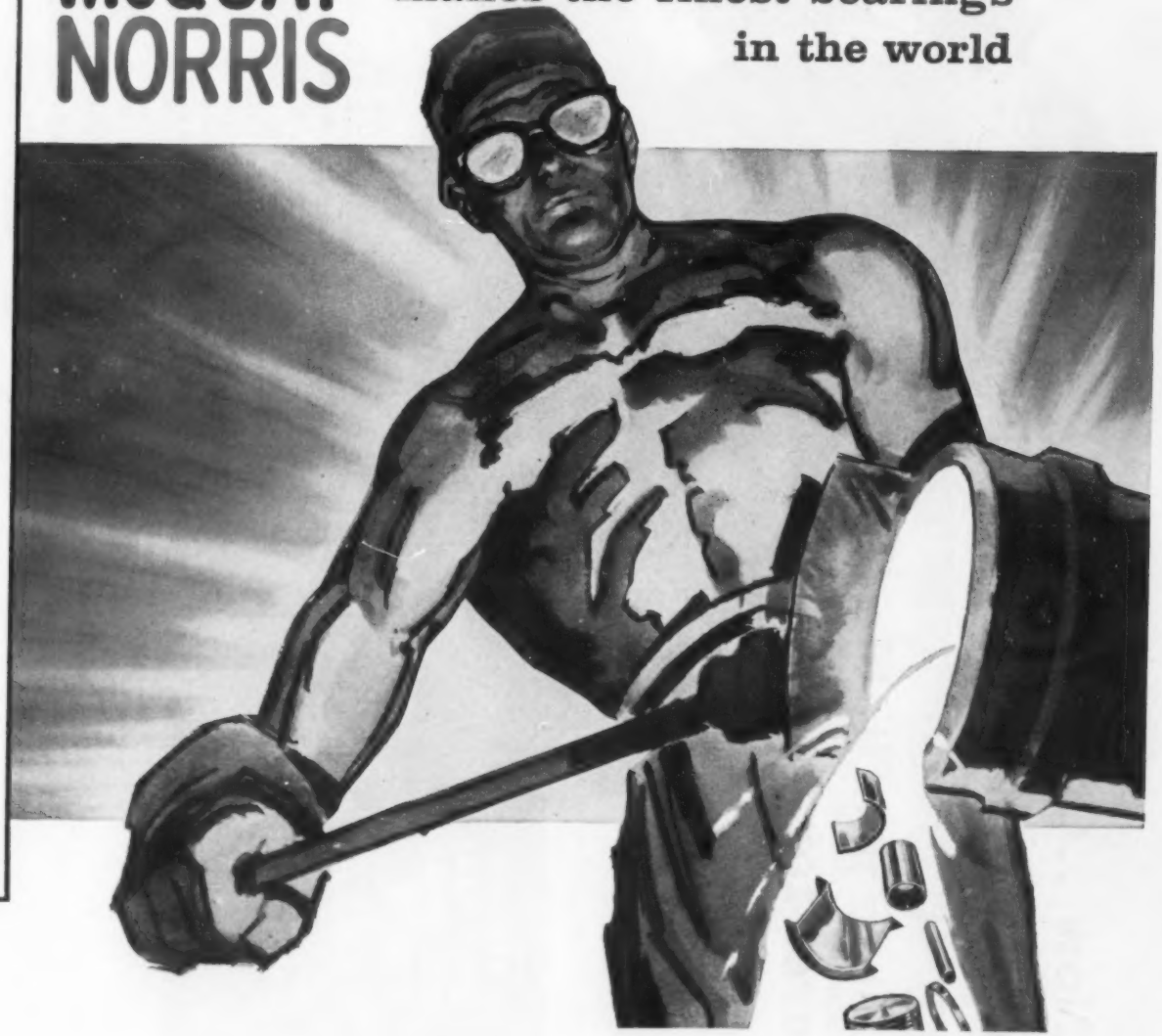

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Servicing the Porsche

General knowledge of the design, observance of necessary clearances, tolerances and torquing specifications opens the door for custom or general maintenance applicable to this small import motor car.

By C. P. EDWARDS

• INCREASINGLY POPULAR among "small car" enthusiasts is the German-made Porsche, a creation of the late Dr. Ferdinand Porsche, designer of the Volkswagen. In fact, many mechanics refer to the Porsche as a plush hot rod version of the Volkswagen. So let's take a closer look at this performance-packed car (Fig. 1) and find out its requirements from a service standpoint.

As good a place as any to start is in the driving compartment, with its array of instruments and controls (Fig. 2). Three large instruments are located immediately ahead of the steering wheel. From left to right, these are the combination oil, temperature and fuel gauge; in the center is a tachometer, and on the right the speedometer.

A red light for the generator and a green light for the oil are located at the extreme left of the combination instrument. The little white button above and to the left of the steering column controls the lights. The white button above and to the right of the steering column is an idling adjustment for cold starting. The starter switch is conventional, being combined with the ignition switch, and is out of sight in Fig. 2, being on the panel to the left of the steering column.

The parking brake below and to the left of the column is applied by pulling the T-shaped handle—released by turning the handle.

CIRCUITS WELL FUSED

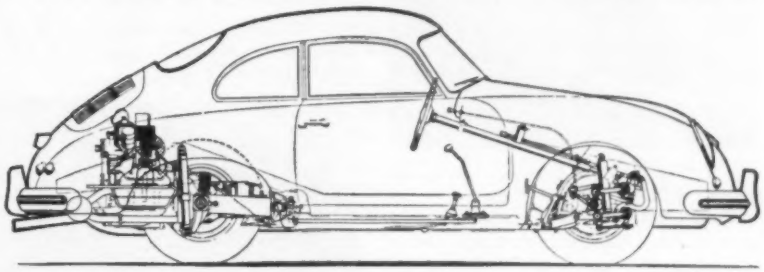
How completely fused all circuits are is well indicated by the fuse block just forward of the panel compartment. Each circuit is clearly marked on the block.

The real "fooler" of the whole deal is the location of the fuel filter and the control lever. Gasoline is carried in the 13 gallon fuel tank on the forward side of the firewall. The generous size of the filler cap, Fig. 3, is obvious when compared with the mechanic's hand as he tightens the connections on the sending unit of the fuel gauge.

The release knob that unlocks the hood and gives access to the tank and also to the battery and spare tire is a small plastic button located immediately above the parking brake handle.

FUEL SHUT-OFF LEVER

Cleaning of the fuel filter (E, Fig. 2) requires turning off the fuel. It is that fuel shut-off deal in the Porsche that can fool the service attendant not Porschally educated. The fuel shut-off lever (F, Fig. 2) is bent L shaped at the instrument panel. There are three positions for this control. The "AUF" position (handle straight down) means that the valve is open. When the



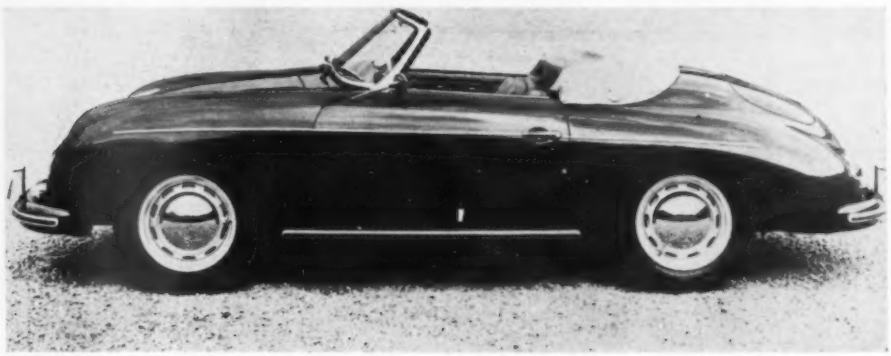


Fig. 1. Left: Porsche Convertible D, lower and lighter than its predecessor, the Porsche Speedster. Above: Cross section, showing chassis and body details.

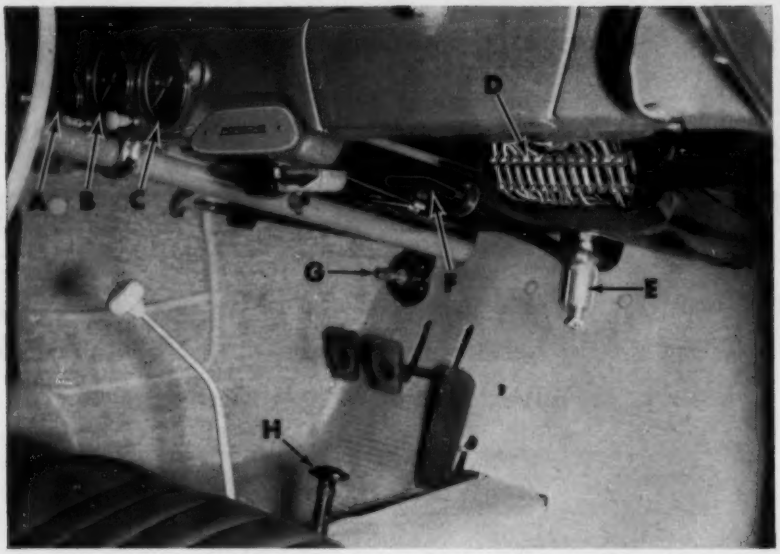


Fig. 2. Driving compartment: A, combination oil temperature, pressure and fuel gauge; B, tachometer; C, speedometer; D, fuse block; E, fuel filter; F, fuel shut-off lever; G, windshield washer; H, heater control.

handle is swung to the left the engine is operating on gasoline reserve.

At the right, marked ZU, the gasoline is shut off. That's fine for working on the fuel filter or even the fuel

Fig. 3. Tightening fuel gauge wires at the sending unit.

pump. With the tank so high above the fuel pump which is on the engine out in the rear compartment you're likely to get pretty well soaked with gasoline unless you know about this shut-off at the tank. And, if a customer has left this fuel shut-off lever pointing to the right, and asks for service work you're not likely to go very far with it unless you know this slight but vital detail.

The heater control (H, Fig. 2) feels somewhat like the valve on a steam radiator. Turn it all the way to the *right* and the heat is *off*. Turn it all the way to the *left*, the heat's *on*.

The shift pattern is diagrammed in Fig. 2. For first—straight forward. Second gear—straight back. Third gear—right and forward. Fourth gear—right and back. Reverse gear—depress lever and shift to the left front.

NO DOUBLE CLUTCHING

The car has a highly developed synchromesh transmission, providing for shifting of gears without intermediate accelerating and double clutching. It is important that the clutch be completely depressed and the shift lever be pushed fully into position.

A release button inside the car on the left wall just back of the driver's seat gives access to the engine compartment. The engine and its major accessories are shown in Fig. 4.

In the Porsche the super engines differ from the normal engines by higher performance and greater torque at top r.p.m. In order to achieve this, the cams and pistons were modified, and the compression ratio increased. The engines continue as air-cooled, 4-cylinder, four cycle, flat fours. The cylinders are horizontally opposed, and the overhead valves are operated by a three bearing camshaft, push rods, and rocker arms.

In effect there is a carburetor for each cylinder in the form of two Zenith dual downshaft carburetors.

LUBRICATION A VITAL POINT

The correct lubrication of the Porsche is a vital matter. The manufacturer emphasizes that only heavy duty oil should be used. When adding oil to the engine, the same brand already in the engine should be added. If this is not possible, the manufacturer insists that the engine be flushed with the new brand, and then refilled.

An oil change is recommended every 3000 miles under normal driving conditions—1500 miles when temperatures are low, runs short, and starts frequent. For warm weather, use S.A.E. 30, in winter S.A.E. 20.

The Fram oil filter, Fig. 5, which is standard equipment, should be changed every 6000 miles. There is also a magnetic filter in the engine pan, reached by hoisting the car or

(Continued on following page)

Fig. 4. Engine and accessories: A, air cleaners; B, ignition coil; C, oil filter; D, generator; E, generator regulator; F, fuel pump; G, No. 1 and 2 ignition cables; H, No. 3 and 4 ignition cables.

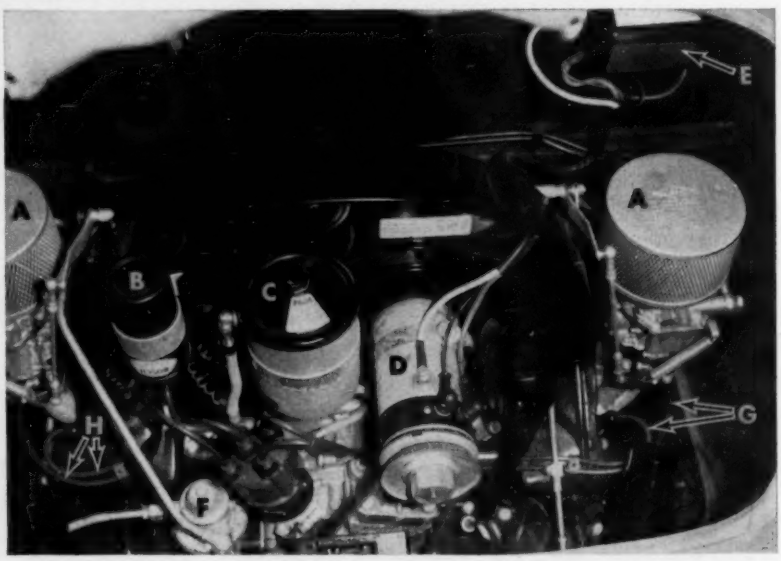


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Fig. 5. Oil filter is serviced in conventional manner.

Fig. 7. Checking spark position with a timing light.

going under the rear end. The engine pan containing this filter is dropped quickly by running off the 10 nuts holding the pan in place. The magnetic oil filter is located at the center of the oil strainer cover enclosing the oil suction tube. All these parts should be rinsed clean in oleum or gasoline and blown dry.

Usual precautions against leakage should be exercised. That is, clean the gasket flanges if the gasket has "decided" to stick half on the engine and half on the pan. Then use a new gasket. If the gasket happens to be "friendly" and appears to have considerable cushion to it, then tighten the pan nuts snugly but not excessively, and wipe the parts to watch for leaks.

While you're under the car, it will be noted that the valves can be reached for inspection or adjustment by removing a metal cover at the right and left sides of the engine. The valve cover is held in place with a stiff spring bale, the action being much like the bale that holds the bowl on a fuel pump, only of much heavier wire with no screw take-up on it.

Valve adjustment calls for a clearance of .004 in. on the intake and .006 in. on the exhaust with the engine *cold*—a blessing for mechanics.

The best sequence for adjusting valves is right straight through, 1, 2, 3, and 4. Before adjusting the valves, the piston of the cylinder affected must be set at TDC on the firing stroke. Take off the distributor cap, Fig. 4, and with the spark plugs out, turn the crankshaft until the points in the distributor are just opening and with the rotor pointing to the cylinder in which you are about to adjust the valves. Note in Fig. 4 that the ignition wires are numbered.

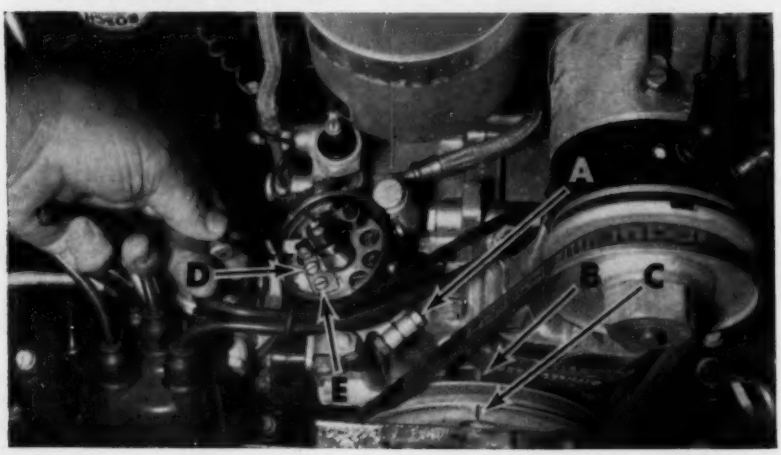
Adjustment procedure is conventional—the lock nut of the rocker arm being loosened with a box wrench while a screwdriver is used to make the adjustment.

When the job is finished, wipe off the rocker box cover and let the engine idle for 10 or 15 minutes. Then check for possible oil leaks.

PORSCHE ENGINE SPECIFICATIONS

Model	Bore & Stroke	Displ. cu.in.	Comp. Ratio	Horsepower @r.p.m.	HP/cu.in.
356A/1300	2.94x2.91	78.7	6.5:1	44@4200	0.55
356A/1300S	2.94x2.91	78.7	8.2:1	60@5500	0.76
356A/1600	3.25x2.91	96.5	7.5:1	60@4500	0.62
356A/1600S	3.25x2.91	96.5	8.5:1	75@5000	0.77
356A/61500GS	3.34x2.59	90.2	9.0:1	128@6400	1.41
550A/1500RS (Spyder)	3.34x2.59	90.2	9.0:1	135@7200	1.41

Fig. 6. Ignition details: A, distributor clamp bolt; B, ignition timing mark on engine; C, timing mark on engine fan pulley; D, contact breaker clamp screw; E, contact breaker adjusting screw.



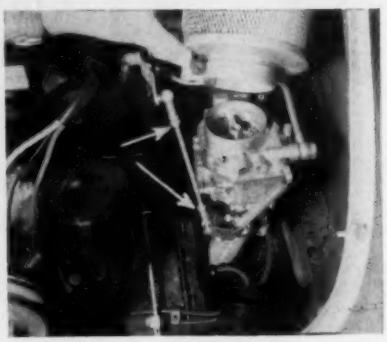


Fig. 8. Removing air cleaner to check carburetor throttle setting. Arrows show lock nuts on linkage adjustment.

TUNE-UP PROCEDURE

A Porsche tune-up follows standard procedures. Spark plugs are removed, cleaned and adjusted to .027-.028 in. Sparking surfaces should be *filed* clean since abrasive cleaners do not get into the surfaces that comprise the gap.

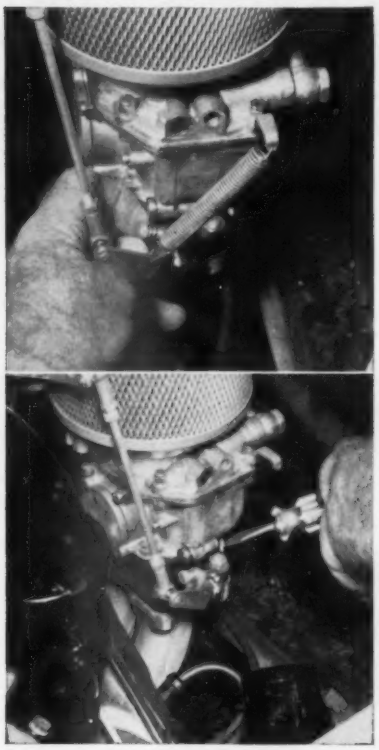
The distributor contact breaker points should have clean square surfaces, and should open .016 in. Adjustment is made by loosening the clamping screw and turning the eccentric screw of the grounded point. The adjustment should be rechecked after the clamping screw is tightened.

The engine is timed at rest. There is the usual distributor clamp and distributor clamp bolt (A, Fig. 6).

The ignition of all Porsche engines should be adjusted so that the spark occurs 5° BTC. Five degrees on the

V-pulley of the engine equals ¼ inch on its rim. The ¼ inch distance should be carefully measured from the center of the notch in the rim in the direction of crankshaft rotation. Mark this location with a pencil. There is a timing mark at top of the crankcase.

To check the engine, crank it until the rotor is approaching the terminal that leads to No. 1 spark plug. Then continue cranking carefully until the pencil mark indicating 5° BTDC aligns with the engine timing mark. Have the distributor clamp bolt just loose enough so the distributor can be turned by hand.



Figs. 9 & 10. Upper view, adjusting idle speed screw; lower view, adjusting idle mixture screw.

Now connect a 6-volt test light between the distributor primary terminal and ground. Turn on the ignition switch. With the points closed this light will not light. Turn the distributor very slowly, counterclockwise, until the points just open, as indicated by the test light flashing on. Tighten the distributor clamp screw and replace the distributor parts that have been removed.

Some mechanics prefer to use the time-proved method of a timing light on the running engine. Since the battery is way up in the "bow," the timing light is connected across the battery and ground leads at the regulator. The flashing of the timing light is triggered by energy from No. 1 spark plug—front plug on the right hand side, Fig. 7. But this is hard to reach. It is easier to run a bare, stiff wire into the No. 1 terminal of the distributor cap and connect the timing light to it.

Fig. 11. Releasing one of two springs which hold battery in place.

CARBURETOR ACTION

There are several steps to proper carburetor action. Naturally it will be important that the fuel lever (F, Fig. 2) be in the ON position, and that the fuel filter (E, Fig. 2) be clean. Likewise, it is important that the strainer in the AC fuel pump (F, Fig. 4) be clean, and that the pump cover be pulled down snugly on a good gasket.

Since the two dual downdraft carburetors are on opposite sides of the engine, it takes a bit of "doing" to be sure that they are working as a well "trained" team. The first step is to remove the air cleaners, Fig. 8. While the air cleaners are off rinse them in clean gasoline and blow them or shake them dry. When dry, oil the filtering parts lightly with the same grade of engine oil that is being used in the engine.

Complete carburetor service on these Zenith units follows standard carburetor practice—soaking all parts clean, blowing the pieces dry, and rebuilding with a rebuild kit. But that's probably more than deserves thorough consideration at the moment.

TEAMING UP CARBURETORS

To team up these two carburetors on opposite sides of the engine, the first step with air filters removed is to see that, with the throttle closed, the throttle butterfly valves are fully shut. Check also to be sure that the actuating linkage does not bind. Any necessary adjustment on the throttle linkage can be made by loosening the lock nut on the ball joints, Fig. 8, turning the rod that connects the joints, and then tightening the lock nuts when the adjustment is complete.

Now replace the air cleaners and let the engine idle until it has reached normal operating temperature. Tighten the idle adjusting screws uniformly on both carburetors, Fig. 9, until engine speed increases very slightly. Now fully, but very gently, close each idle mixture screw, Fig. 10, until it bottoms gently. Then open it exactly 1½ turns. This 1½ turn basic setting will enable the engine to operate.

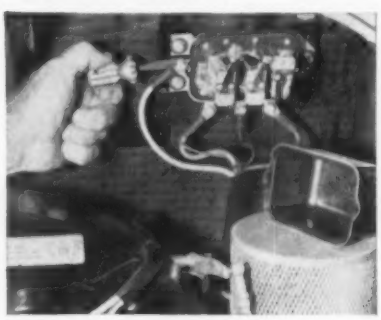
TACH A GREAT HELP

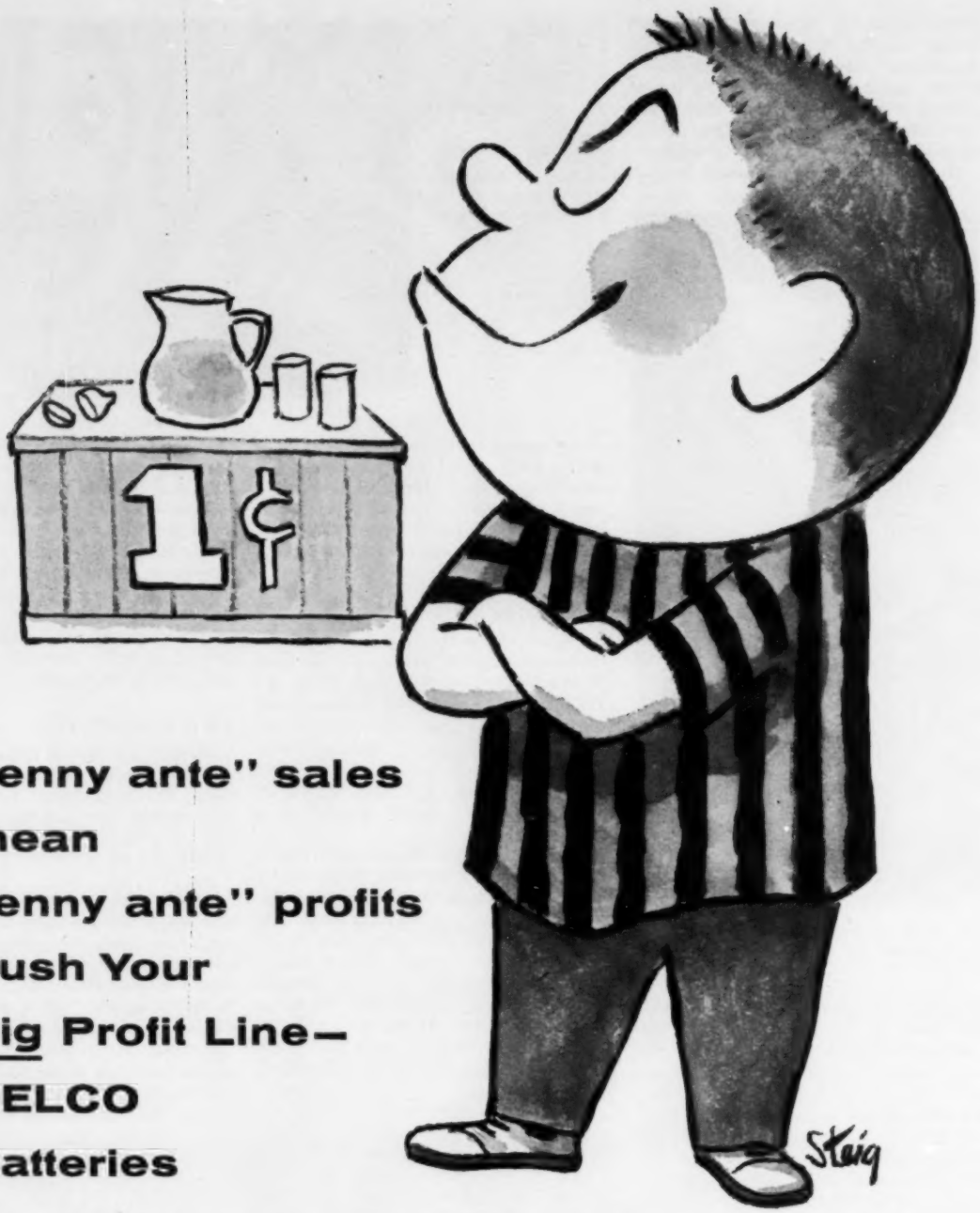
Skilled mechanics find a tachometer a great aid in adjusting carburetors. With the tachometer attached, bring the engine speed of the type 1600 to 600 to 800 r.p.m. The type 1600S should be idled between 700 and 900 r.p.m.

While watching the tachometer for the slightest change, take one idle mixture screw, Fig. 10, and turn it very slowly clockwise until the engine speed drops off ever so slightly. Then turn the screw very gently counterclockwise until the speed has picked up again. Next, turn the adjustment clockwise once more as far as can be done yet *without losing any engine speed*. Repeat this procedure on the other three low speed mixture screws. That will get both carburetors and

(Continued on page 57)

Fig. 12. Tightening the ground lead at the generator regulator.





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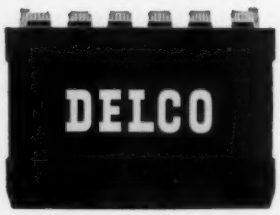

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Colors and color mixing

Technical developments have brought a far wider range of colors, as well as greatly improved properties to automotive finishes. Once the fundamentals are mastered, it is simple to work successfully with these new materials.

By GUY F. WETZEL
Technical Editor

• IN THE DAYS when automobiles were considered more or less as motorized carriages, coach finishing techniques were employed. Several undercoats of color varnish, one or more coats of rubbing varnish, and finally a coat of slow drying finishing varnish were required to produce a high gloss. To finish an automobile took from 10 to 20 days elapsed time, prohibitive under modern requirements.

To meet present demands for suitable materials, body finish must be available in a wide variety of attractive colors with an attractive surface appearance. It must be able to withstand desert heat and sun without becoming soft. It must withstand subzero temperatures without becoming brittle. It must withstand constant exposure to sun, rain, snow, salt air, without premature dulling or failure. It must have abrasion resistance to withstand wear. It must have good adhesion and be flexible enough to withstand a reasonable amount of abuse and mechanical damage. Finally it must be capable of repair in the body service shop.

ACRYLICS HOLD MORE PIGMENT

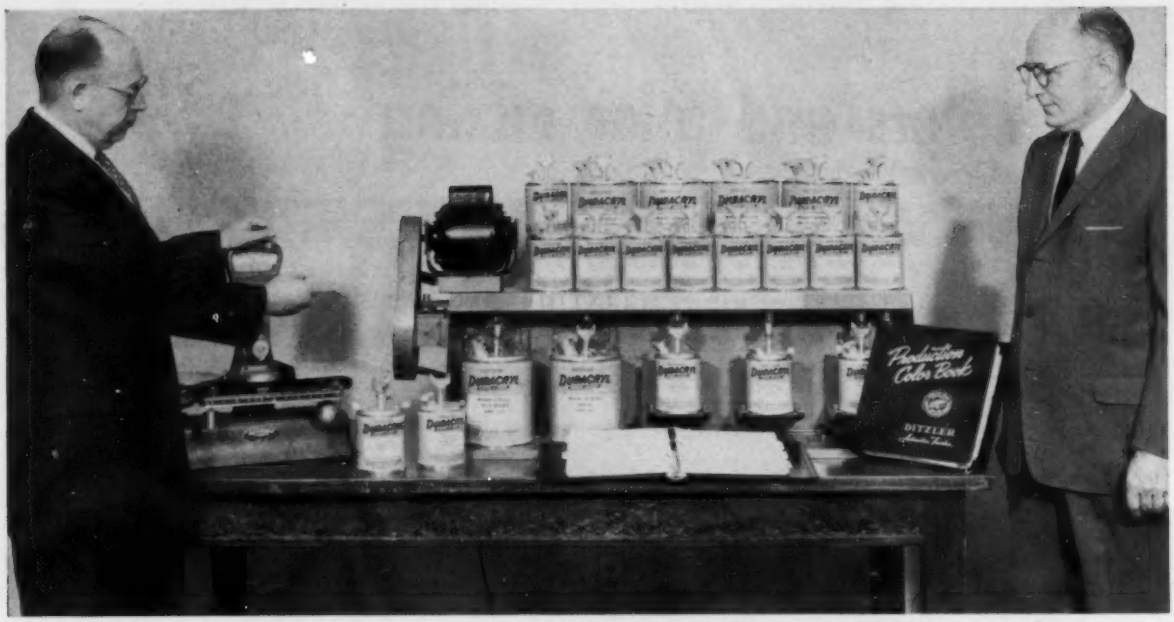
Modern automotive finishes fulfill these requirements admirably, especially the new acrylic type finishes. An outstanding characteristic of the new finishes is their ability to hold more pigment material. There has also been much improvement in the pigments, or dry colors, now available. Ten or 15 years ago most of the body colors were drab and subdued because there were very few permanent bright colors or light-fast pastel tints or shades. Neither were there any of the non-yellowing enamel vehicles or resins, essential for use with the brilliantly light colors. General developments in the plastics industry have made available materials which have changed the methods of paint manufacture.

The introduction of phthalocyanine blues and greens, indanthrene blue and certain metalized azo dyes, has opened up color applications never before possible. The transparency of these colors has facilitated making an array of metallic colors never before obtainable. The introduction of titanium oxide, modified by other metal oxides, has had an important effect in developing extremely light tints in body enamels and lacquers during the past four or five years. White is used in substantial proportions in all of the light colors. In fact, most of the light colors are tinted white materials.

Improved maroon pigments have widened the range of this group of colors and thio indigo reds and cadmium selenides have expanded the choice of solid red hues from light, yellowish reds to deep reds. The relatively new arylide maroons have opened up the field of metallic maroons in enamel, so they now are competitive with the glamorous lacquers that were widely used for several years.

Iron blues and high color carbon blacks have been improved so that, in enamel, they compare favorably with the lacquers previously supplied. Advances also have been made in developing better non-leafing alumi-

A good color match requires color perception, patience, care, mixing know-how and good materials (photo courtesy Martin-Senour).



Ditzler's recently developed mixing color system for repairing new acrylic finishes being demonstrated by Harold Redshaw (left) Technical Director of the Ditzler Color Division, Pittsburgh Plate Glass Company.

num bronzes with improved dispersion properties and superior stability for use in the metallic paints.

While attention has been centered to a certain extent on the new acrylics in the lacquer field, improvements also have taken place in the enamel field, resulting in higher standards of performance. The improved resins and solvents allow much higher solids content, resulting in easier spraying, higher gloss, better fullness, less shrinkage into pores and sand scratches in the undercoats, also less orange peel.

Automotive finishing materials are used (1) in the factories on new cars, (2) for repainting entire cars, (3) for painting new body parts which replace damaged parts, and (4) for painting areas that have had metal repair or straightening whereby bare metal has been exposed.

OBTAINABLE TWO WAYS

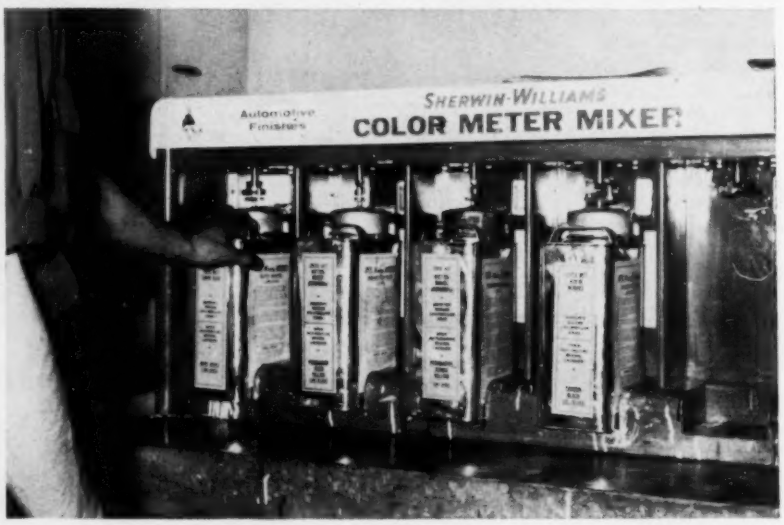
The painter in the service shop has the choice of two methods for getting lacquer or enamel of the desired color for each job. One way is to order from a paint supply house or the paint department of a parts supply house, the specific pint, quart, half gallon, gallon or more that is needed for a particular job. The other way is to put in a full line of approximately thirty basic colors with lacquer base and thirty with enamel-base, along with a supply of the other ingredients and equipment for mixing his own colors.

It would appear at first that the simplest way to get the desired lacquer or enamel for a certain job would be to order it from a supplier. But, good as the finishing materials are, there is a certain amount of fading or change in the original color in many cases, due to weathering, exposure to the sun, rain, chemical vapors, salt air and so on.

This means that where doors, hoods, trunk lids, quarter panels, or other body parts (replacements) are to be painted, or such parts have been repaired and need repainting, the newly applied color must match closely the color of the original finish. Therefore, modification of the factory-mixed, or formula-mixed paint will be required.

In general, if only fading has occurred, lightening the material by the addition of the proper white may be sufficient. But if the color has changed, the new finishing material may have to be made (1) redder, (2) yellower, (3) greener, (4) bluer, (5) grayer, (6) browner, or (7) deeper. Tinting guides, which give instructions as to what particular tinting

Completely mixing the color in the can before pouring any of it is an important operation. Unless the contents of the can becomes uniform through-out its entire volume the formulation will not be accurate. The mixing rack shown has power driven spaces for five cans.



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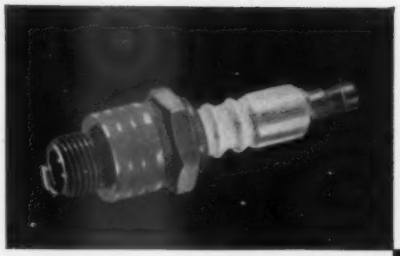

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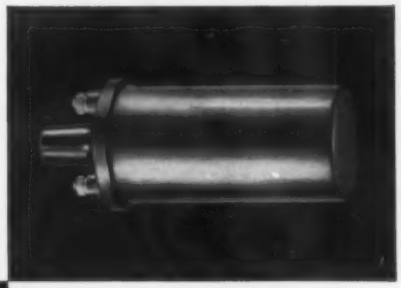

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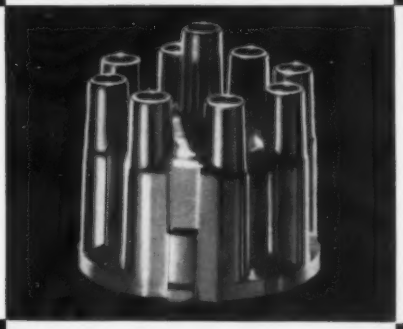

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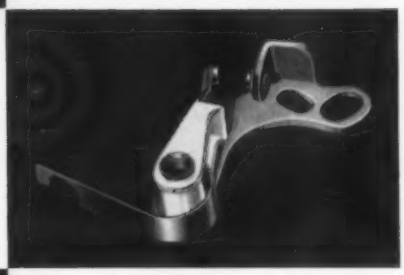
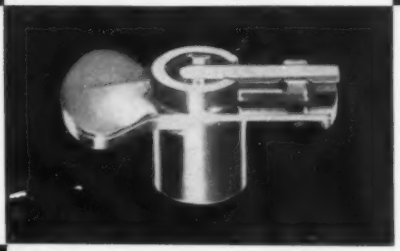
Pre-assembled and pre-aligned for 50% faster installation—saves valuable time for other jobs.



MOPAR DISTRIBUTOR CONDENSER
Chrysler-engineered for balanced performance with MoPar breaker points.



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Ten Auto-Lite Power Point sets cover 99% of all applications from 1946 through 1959, plus many earlier installations.

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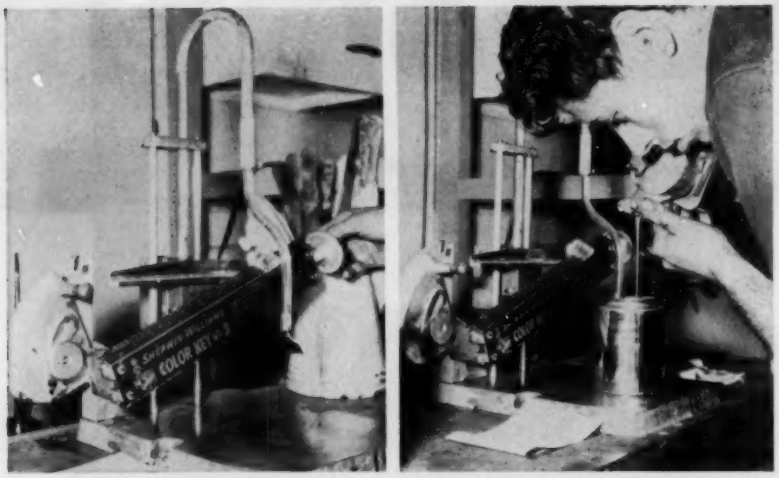


Apparatus for compounding colors by volume specifications. The point of the tip on the dip-stick just enters the surface of the color being poured in the can. When the liquid surface just reaches the corner at the left end of the inclined edge, the pouring is stopped and the right amount of color will have been added. The height of the dip-stick tip is raised to the exact point to indicate the addition of the next component, accurate to about one drop. Apparatus makes allowance for the correct container size. Right, color mixer compounding a quart of a specified hue.

colors should be used to swing the color in one of these directions, are furnished by the paint manufacturer.

All shops where painting is done should have an ample supply of tinting colors for both lacquer and enamel, to use where modification of the color is required for a perfect match.

Suppliers to the painting shops carry a large stock of factory mixed colors that are standard on car models for the previous 4 or 5 years. They also stock the full line of base colors for automotive use—30 to 35 enamel-base and the same for lacquer base material. Paint manufacturers supply formulas for mixing about any color that may be required for cars as far back as 15 to 20 years. They are also supplying formulas for foreign car colors, for which there is an increasing demand.

These formulas specify the exact amount of each component color for a mixture that will be the same as the original factory color for the particular car.

MEASURING COLOR COMPONENTS

There are two ways of measuring the amounts of component color: (1) by weight, weighing the addition of each color on a very sensitive balance; (2) by volume, using a sensitive adjustable device to measure accurately the amount of each component color added. Each method is practical and will produce acceptable results.

Some paint makers supply the formulas in loose leaf book form, others on file cards. The file cards are convenient because they can be removed from the file and put in a card holder on the color measuring machine for easy reference. On the other hand, the cards may become misplaced, misfiled or lost. It's a matter of personal choice.

Paint · departments in automobile dealers' shops usually carry an inventory of the standard colors used on their make of car. But shops doing work on all makes seldom know what is coming in, and so, either draw on the stock of their paint supplier or have a stock of base colors and mix their own. In shops which have two or more full time painters it pays to maintain a color stock. In some cases it pays a one-man shop to do so. Where paint is ordered from a supplier, there is always waiting time for delivery.

In addition to the measuring device for formulating color combinations (which may be either a scale or a volume measuring machine) color compounding requires a mixing rack that will hold from five to thirty-five cans to be stirred simultaneously. The mixing or stirring rack may be from five to seven or eight cans wide and from one to five shelves high, and is power driven.

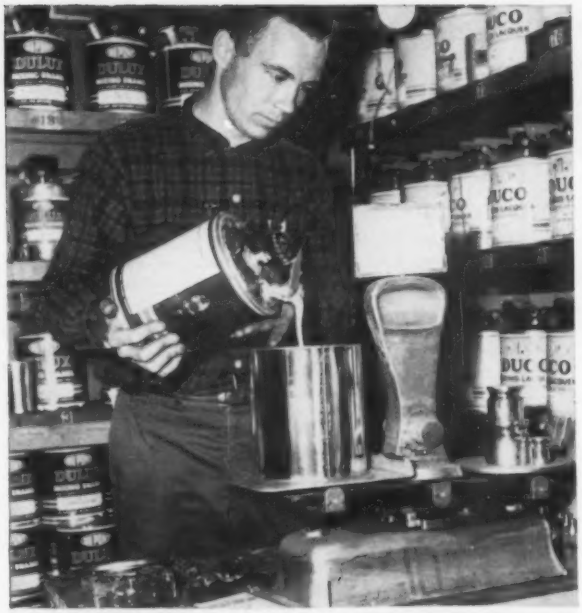
One of the essential considerations in using either lacquer or enamel is to have it uniform throughout the container. The only way this can be accomplished is to mix the material thoroughly. It is obvious that unless all the material in a container is uniformly distributed, with no concentrations of pigment, vehicle or thinner, the effect of mixing it with other colors will be neither uniform nor effective.

After a formula is made up in the size of container—pint, quart, half gallon or gallon—the container should be put on a shading machine to be sure the component colors are all thoroughly distributed and mixed. It is well to stop the machine and turn the can upside down for further agitation before use.

The ability to match colors is large-

Compounding color by weight. Weights (not shown) according to formula, are balanced as ingredients are poured in, one at a time.

ly a matter of experience; but there are some "tips" that will be of help to the beginner in the business. Three fundamentals must be observed by everyone who wants to become proficient in color matching. These are: (1) a normal color perception, (2) the proper tinting materials, and (3) knowledge of how each tinting color will act and its effect when combined with other colors.



Scale, weights and mixing racks are shown, one for lacquer, one for enamel. Thirty-five cans can be mixed simultaneously in each rack.

To get greater accuracy in mixing quarts or pints, the smaller scale is often used. It is more sensitive than the larger scale.

COLOR PERCEPTION

Color perception means the ability to see colors as they normally appear. With normal color perception, matching colors becomes a matter of patience, care and meticulous following of instructions, plus, of course, items (2) and (3) mentioned.

The right tinting colors mentioned previously, are single pigment colors, uniform in tinting strength. They should be on hand in both lacquer base and enamel base vehicles. If substitutes are used, there is danger that the final product will not be satisfactory because of a poor color match, excessive fading, checking, chalking, or "throw-out" resulting in a lumpy condition. Do not try to tint with multiple pigment colors, that is, mixtures of colors already combined. It will be difficult to predict the final effect, whereas single pigment colors will have the desired tinting effect. Shades and tints that are wanted can then be reproduced.

The Ditzler Color Division, Pittsburgh Plate Glass Company, recently introduced a color mixing system for repairing new acrylic finishes. The company states that this system is a practical, workable method of quickly duplicating thousands of colors with factory accuracy from a small stock of base tinting colors. These bases include:

White	Oxide yellow
Tinting black	Rich brown
Organic blue	Poly base
Black	Burnt sienna
Oxide red	Organic green
Coarse poly base	Burnt umber

GIVES GREATER FLEXIBILITY

With D'tzler's new color mixing service all base colors are stirred by power agitating devices that can be purchased and assembled in units suitable for any size operation. This permits necessary flexibility to meet special requirements.

Measuring of colors is done by means of a carefully made and calibrated weight scale. Quantities as small as one five-thousandths of a gallon can be accurately weighed in the gun cup or can.

This accuracy combined with a complete formula service, results in a paint shop not only being able to duplicate a color exactly but also to do it repeatedly with the same precision, the company states.

Nearly every automobile color contains some black. A large number of colors contain white in some proportion, and others contain varying quantities of green, yellow, blue, red, maroon, etc. The list given here is not complete, but does contain the single pigment colors that are most used and will be suitable for at least 75 percent of the paint jobs. It is advisable to buy tinting black and white in gallons, and the other basis in quarts. Except for the white and black, only small amounts of the colors will be used for each tinting operation. It is important that each one be thoroughly stirred before using, to be sure of a uniform tinting strength. Lacquers should always be tinted with lacquer base colors, enamels with enamel base colors. Never tint either lacquer or enamel with Japan colors or colors in oil.

It is important to know how tinting colors will behave when they are added to hundreds of different color combinations. With a set of standard tinting colors at hand it becomes largely a matter of experience and practice to get this knowledge. The

person doing the tinting must learn that each color has what is known as a "mass tone" and "tint tone." The mass tone can be judged from the color as it appears in the can or as it would look on a painted panel. The tint tone is that obtained from mixing a small amount of color with a large amount of white.

The effect obtained from adding the color to white will be similar to that obtained from adding it to other colors, but in less vivid form. For example, a dark green mass tone will usually have a blue tint tone while most maroons will have a purple or violet tint tone. It is usually impractical to add white to dark green to get a light green, or white to maroon to get a light red. It is well to remember that small additions of color will tint according to their tint tone, while large amounts will affect the color mixing according to their mass tone.

Tinting the polychromatic or metallic shades is different from tinting colors that do not contain aluminum pigment. The presence of aluminum makes the apparent hue of color vary from dark to light or from light to dark, depending on the angle from which the surface is viewed. In this case the tint tone will be most effective on the color seen when looking directly into the can. When looking at it from an angle the mass tone will have the greatest effect.

When white is used in metallic colors it seems to hide the effect of the aluminum to a certain extent and reduces the degree of color change which will appear in the applied finish. The effect of white varies with different colors. Sometimes a little white will be needed to get a good match; yet with some color combinations, the addition of white actually ruins the color.

PIGMENTS USED IN MIXING

Bone Black is a carbon pigment obtained from the destructive distillation of bones. The percentage of carbon amounts only to 12 to 20 percent. It also contains calcium phosphate. Its shade is not as black as lamp black, or ordinary carbon black, but is suitable for mixing and shading. It does not bleed.

Close up of mixing rack. Each gallon can has a mixing top, in place of original sealing top, and is fitted with a spiral paddle agitator.

White for mixing is titanium dioxide, obtained from titanium ores. As prepared for pigment use it has a high index of refraction which gives excellent resistance to weathering.

Sienna is a natural earth color related to ochres and umbers. It is used as raw sienna and burnt sienna (darker). It is light-fast, has good covering, and is non-bleeding with lacquers.

Oxide Red and Indian Red Oxide are pure iron oxides. They have excellent opacity and resistance to sunlight and weathering.

Permanent Toning Yellow is a commercially-pure hydrated ferric oxide that contains about 85 percent iron oxide. It has high tinting strength and excellent permanence in both full shade and in tints.

Opalescent (Fine, Regular, Coarse) is pure aluminum of varied particle sizes used in the form of a paste in which the aluminum powder is wetted with a solvent compatible with the vehicle.

Carbon Black pigment is made by collecting the soot deposited by a sooty flame. It contains 85 to 90 percent carbon, is jet black compared with bone black or lamp black; has excellent opacity, permanence and tinting strength.

Light and Dark Chrome Green are mixtures of chrome yellow and Prussian blue. Varying proportions of yellow and blue will vary the shades of green. Full shades cover well and have relatively good permanence, but the tints are fugitive, not fast to light.

Prussian Blue or Iron blue is made from prussiate of soda. In full shade the color is very deep and has good permanence; but it is not light fast when used for tinting.

Phthalocyanine Blue is one of the newer chemical colors. It can be used in light tints and has excellent permanence.

Lemon Yellow and Chrome Yellow are light and medium chrome yellows, respectively, prepared from soluble lead compounds and sodium bichromate. They have good brightness and opacity, with satisfactory permanence in full shade. If used in tints there is liable to be some color change. Other yellows provide better permanence in tints.

Brilliant Green uses an inorganic green known as Guignets green. It is a hydrated chromium oxide; has excellent light fastness (particularly when used with aluminum), brilliance and transparency.

Extra Dark Green uses a chemical iron salt with a very dark green color. It blends well with other colors to produce deep greens. It has good permanence.

Permanent Purple Blue uses a vat color called Indanthrene blue. It has unusual strength and permanence and can be used for the most delicate tints.

Permanent Green Yellow uses an organic metallic type of pigment. It is

(Continued on page 44)

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Over the years the little black box formerly hidden under the floor boards has taken on a new look. Only a little bigger than a decade or two ago, it packs a far greater wallop because . . .

Battery loads have doubled since 1950

● IN A RECENT address by D. L. Boyes, General Manager, Delco-Remy Division, General Motors Corp., before the oil industry TBA group, the speaker discussed performance comparisons of various capacity batteries. He presented several charts giving a more graphic picture of the progress in battery design over the past two decades and which pointed up the exacting specifications that today's motor car demands of its battery. Several of these charts are reproduced herewith.

After tracing the historical background of the storage battery from the days of the French chemist Plante in 1859, Mr. Boyes said that following World War II, the battery business, by necessity, began to take on its own new look.

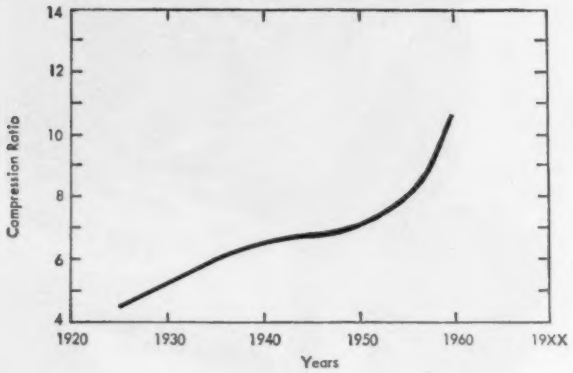


Chart 2 — Engine compression ratio trend is decidedly up since 1950.

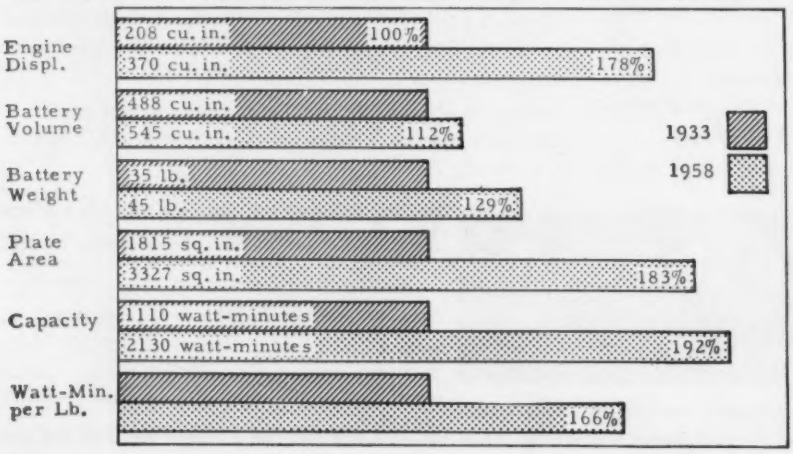
SHIFT TO V-8s POSED PROBLEMS

For one thing, it became apparent that the V-8 engine had certain advantages over the in-line type and the entire industry shifted rapidly to the V-8 design. Problems were immediately posed from the battery mounting standpoint. Usual locations were out; new mountings had to be designed in many instances.

New engines developed during the last decade have placed much more exacting requirements on the battery maker. Increase in compression ratio was one. It made possible more power per cubic inch of displacement, but resulted in greatly increased ignition requirements. This and other essentials dictated the switch from 6-volt electrical systems to 12-volt early in the 50's. The battery industry had to step up to a wide variety of 12-volt models and continue to make the 6-volt units for the motor vehicles already on the road.

During recent years, new equipment—power brakes, power steering and air conditioning—has created demands for space under the hood. This, with the stylist's trend to lower and lower hood lines has left space for batteries at a premium. It accounts for the far wider variety of battery models required to properly service the car owner's needs.

Chart 1—Twenty-five year progress in battery design. With a battery package only a little bigger than 25 years ago, almost twice as much electrical energy is being delivered.



"HOT STALL" OR "DIESELING"

Regarding cold and hot engine cranking ability of batteries in former years, cold cranking was the chief problem. But, with the newer engines, there are conditions in which cranking requirements are higher in summer than winter. The condition is referred to as "hot stall," existing sometimes when attempt is made to restart an engine after it has been stopped for a few minutes. Some engineers refer to the condition as "dieseling." It results from the gas in the cylinders being ignited by compression and heat rather than by the ignition spark. It causes a force to act upon the piston in a direction opposite to that applied by the starting motor. This creates the stall condition and prevents cranking. After a few min-

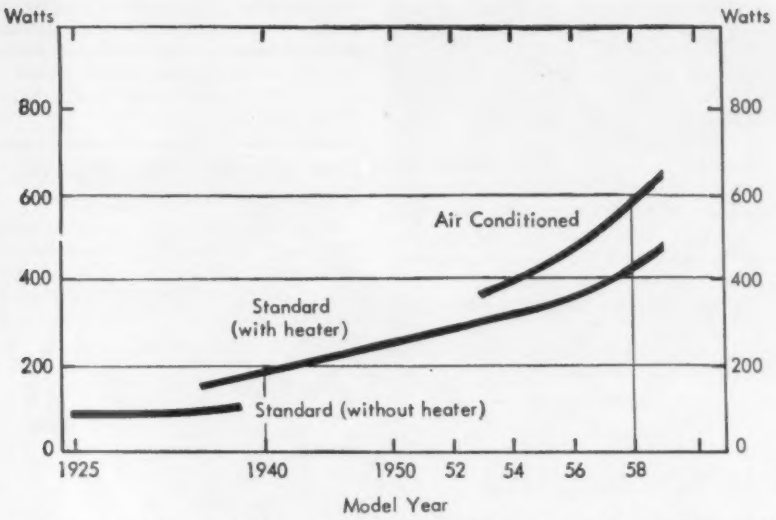


Chart 3—Electrical loads for passenger cars. Since 1940 the electrical loads have more than doubled on standard cars with heaters; tripled, on cars equipped with air conditioning.

utes, normal cranking can take place as the heat has been dissipated.

Mr. Boyes stated that the way this trouble is overcome is through a cranking system with sufficient acceleration so the piston can be rapidly brought up over dead center before pre-ignition occurs. Such a cranking system requires a considerable amount of torque and many measurements have shown that torque requirements and ampere drain are higher under these conditions than they are in cold weather. Therefore, the automobile manufacturer must select a battery and starting motor combination that will meet the hot conditions as well as the cold conditions.

25 YEARS OF PROGRESS

Shown in Chart 1 is 25 years of progress in battery design. For comparison purposes, a 1933 model car is used, having a 208 cu. in. engine and a 1958 version of the same car which now has a 370 cu. in. engine. Using the 1933 engine and battery as 100 percent, in terms of cu. in. displacement, the 1958 engine is 178 percent; the battery volume, 112 percent; the battery weight, 192 percent; the plate area of the battery, 183 percent; available power of the battery in terms of cold cranking, 192 percent; watt-minutes per pound, 166 percent.

Thus, with a battery package only slightly larger than it was 25 years ago, almost twice as much electrical energy is being delivered.

COMPRESSION RATIO TREND

Chart 2 shows the trend in engine compression ratios, from 4.5:1 in 1925 to 7:1 in 1950, to 10.5:1 on 1959 model engines. The current atmosphere of rapid change is graphically illustrated by the fact that the increase in 9 years (since 1950) is greater than the increase in the 25-year period before 1950.

With cold cranking, compression ratio is not a big factor. With hot cranking, however, it is a big factor as the higher the ratio the more prevalent is "hot stall."

Chart 3 shows a curve depicting the records of electrical loads on passenger cars since about 1925. The electrical loads are composed of what battery manufacturers call "continuous loads." Intermittent loads such as horns, turn signals, starting motor cranking, and so on, are not included.

While battery manufacturers have been advised periodically by motor car engineers that electrical loads will not be increased, the curve in Chart 3 shows a continuous rise. Notice, for example, that since 1940 the electrical loads have a little more than doubled on standard cars with heaters. On cars equipped with air conditioning, the load has tripled.

As Mr. Boyes stated in his talk, the electrical load is quite a factor in choosing an adequate battery. As the load is increased, the amount of current drain during city driving also is increased. Driving speed in congested areas averages only about 12 m.p.h. This means that more than half of the time the car is either stopped or in traffic conditions, during which the generator is not charging the battery. This condition is accentuated on air conditioned cars in warm climates, because of high electrical loads both day and night.

ENGINE DISPLACEMENT ALSO UP

The trend in engine displacement affects battery requirements. The

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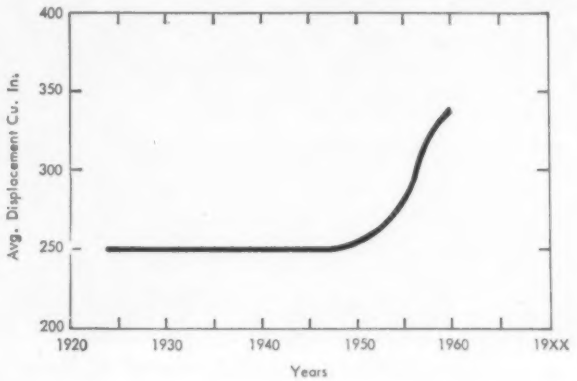

Chart 4 — Engine displacement trend, rather constant from 1925 to 1950, took a decided upward swing in 1950.

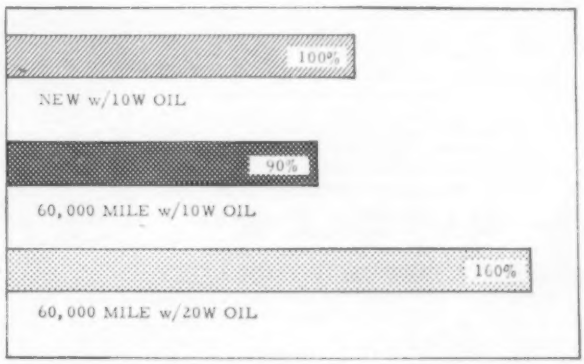

Chart 5—Cranking torque requirement at 0° F. on new and 60,000 mile engines.

average cubic-inch displacement of motor car engines was quite constant through the years 1925 to 1950, as noted in Chart 4.

From 1950 to date, the rise in piston displacement has been about 30 percent, from 250 to 325 cu. in. In general, the cubic inch piston displacement dictates the cranking motor torque (turning effort) requirements. The battery capacity must be increased in line with the cranking requirements.

In 1925, the starting motor rating was .75 hp.; in 1950, it was 1.00 hp.; and in 1958, 1.62 hp.

An interesting point brought out in the talk had to do with the cranking torque requirement at 0° F., on new and 60,000-mile engines. Graphically, this is shown in Chart 5.

It has been the general impression by the industry, according to Mr. Boyes, that after you have a few thousand miles on a car, the engine "loosens" enough so that almost any battery will be suitable. If an engine is kept in reasonably good operating condition, the cranking torque requirements do not decrease as rapidly as is commonly thought.

Chart 5 shows that on a car which had been driven 60,000 miles, the cranking torque requirement was only 10 percent less than when the car was new. If the owner of this car thinks he should use 20-W oil instead of 10-W because of the mileage on the car, his cranking requirement then is 60 percent *greater* than it was when the engine was new.

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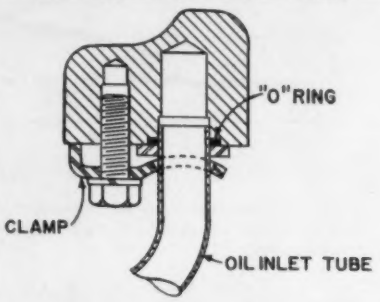
Low Idle Pressure Due to Distorted Oil Pump Inlet

American Motors advises that on its 5901 and 10 Series, low oil pressure at idle speed may be caused by a distorted oil pump inlet tube flange or insecure mounting of the inlet tube to



the crankcase, preventing the gasket from effecting a perfect seal.

The flange surface may be checked and corrected with the use of crocus cloth placed on a section of plate glass to insure a flat surface.

A change in design utilizes a clamp secured by one cap screw to bear down on a flange and compress an "O" ring seal to provide a positive and leakproof method of attachment, as shown in the illustration.

Rocker Arm Support Holes Can Cause Plug Fouling

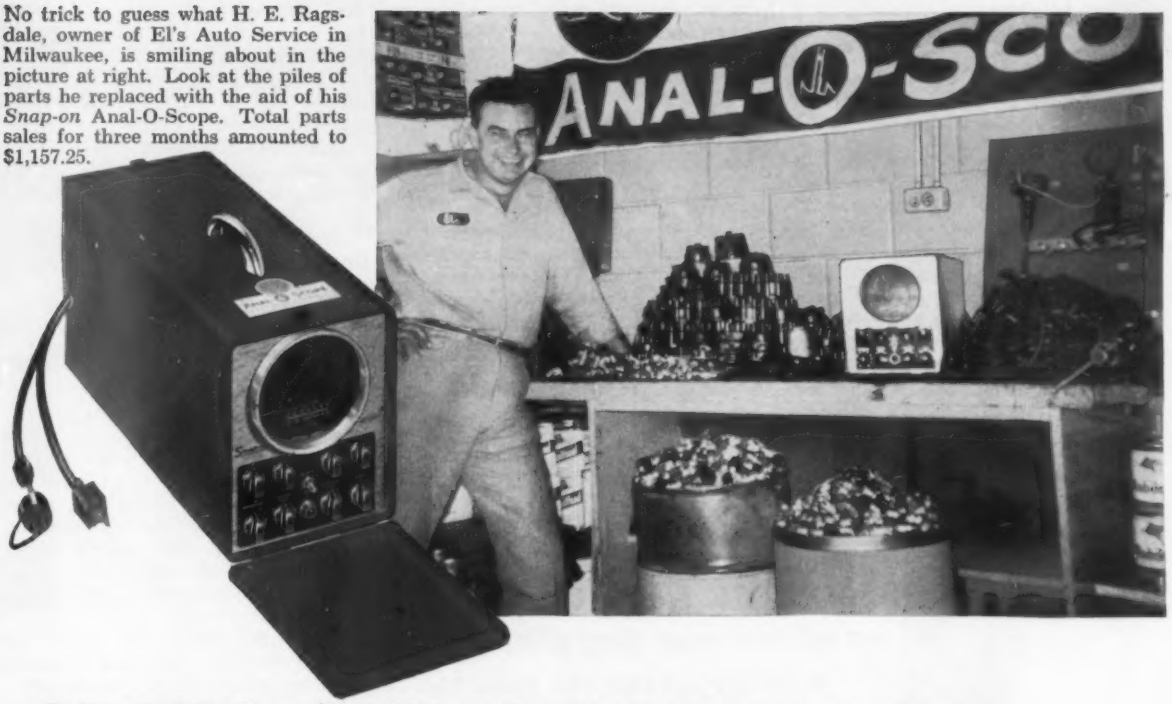
You may never run into this situation, but you should file this tip in one of your spare brain cells: Unusual oil fouling of spark plugs or excessive exhaust smoke *may* be caused by rocker arm shaft hold-down bolt holes opening into the intake manifold.

In a few cases production engines have had the bolt holes drilled too deep, allowing oil to seep around the bolt threads. This leakage occurs most frequently in areas where long downhill stretches build high vacuums in the intake manifold.

If all the ordinary sources of oil fouling have been eliminated, check this possibility by removing the rocker arm assemblies. Then prop open the throttle plates and apply air pressure to the hold-down bolt holes in the cylinder head. If air hisses out of the carburetor throat, there's at least one of the bolt holes drilled too deep.

Most manufacturers can supply replacement studs and sealer for this condition. *If you find any blind holes, however, be sure to blow out all oil before installing the studs.*

No trick to guess what H. E. Ragsdale, owner of El's Auto Service in Milwaukee, is smiling about in the picture at right. Look at the piles of parts he replaced with the aid of his *Snap-on* Anal-O-Scope. Total parts sales for three months amounted to $1,157.25.



90 DAYS – $1,157.25 IN PARTS ALONE WITH NEW Snap-on ANAL-O-SCOPE

Snap-on Tools Corporation
3450 North 84th Street
Milwaukee, Wisconsin

Gentlemen:

Three months ago we purchased a Snap-on Anal-O-Scope.

We are not writing you to make a complaint, but rather to tell you that we think it was the smartest equipment purchase that we have ever made.

Our shop has already taken a lot of pride in turning out quality work. We sincerely believe that the scope is adding to that quality with every ignition job performed, and is making new and more satisfied customers for us.

We are happy with the added quality in our work, but more happy with the added profits the Anal-O-Scope is bringing in to us now. Our ignition parts sales for the three months we have had the scope totaled $1,157.25 plus labor on 56 tune-up jobs.

We definitely feel that better than 90 percent of these sales were direct results of Anal-O-Scope ignition analyses made. It's wonderful to be able to show the customer that "before" and "after" picture, and to have the confidence that he is leaving our shop satisfied and happy with the work done.

We would like to take this opportunity to thank you for your field help in training our mechanics in the use of this customer-satisfying and profit-making piece of equipment.

Sincerely,

EL'S AUTO SERVICE

H. E. Ragsdale

H. E. Ragsdale

Read this letter from
EL'S AUTO SERVICE

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MT-615 Anal-O-Scope
available on easy payments

SNAP-ON TOOLS
CORPORATION
8018-C 28th Avenue • Kenosha, Wisconsin

Color Mixing . . .

(Continued from page 38)

recommended for use as a tinting yellow because of its tinting strength and permanence.

Toluidine Red, Light Maroon, Deep Maroon, Brilliant Maroon use pigments of the Azo pigment dyestuff type, insoluble in water but slightly soluble in lacquer solvents. Have a tendency to bleed through light colored lacquer coatings applied over them. They give very bright colors in lacquer and good permanence in full shade and as mixtures in red and maroon colors. Not recommended for use in light tints made with white or aluminum.

Permanent Toning Maroon uses a vat color of the thio-indigo type, used mainly as tinting maroon pigment as it has excellent strength and permanence in tints.

These are most of the mixing colors supplied by Sherwin-Williams. Other companies may use different names but the basic pigments are much the same in all paint makers' products.

With both lacquer and enamel it is essential that the correct and most suitable thinners be used. There are some cheaper thinners suitable for primer and undercoats. But for the final lacquer coats, only the specified thinner should be used to get the best paint flow and final surface.

Some of the manufacturers are supplying a dual purpose thinner that can be used for either lacquer or acrylic. This simplifies somewhat the problem of stocking and storing the thinner supply. This thinner should not be used for enamels.

One paint maker, Martin-Senour, is supplying lacquers in pressurized cans from which the material can be sprayed on touch-up work. Naturally this can only be used on standard colors where no tinting is involved.

MATCHING A COMPLEX JOB

The work of painting parts and repaired surfaces on automobile bodies so that they will match the rest of the painted areas is getting more complex each year. The lighter colors require greater accuracy in matching than the darker ones, and the many two-tone combinations frequently require the matching of two colors instead of one.

Where the entire car is to be painted it is only necessary to arrive at a color satisfactory to the customer, and then apply it. No color matching involved.

The skill, knowledge and ability that a good painter has to have these days is not generally appreciated. He has to prepare the metal or previously painted surface to receive the new paint coat, match the color perfectly, apply the finishing material, and finally turn out the job with a glamorous finish that will satisfy the customer. The fine lacquers, enamels, acrylics, thinners, tinting colors, etc., which are available make it possible to produce beautiful and durable auto finishes. However, the best of materials are without value if not properly and expertly applied.

Herbrand tool of the month
an all use snap ring plier with replaceable points!

INTERNAL SNAP-RING PLIER NO. AT-60

EXTERNAL SNAP-RING PLIER NO. AT-61

Because of its replaceable and reversible tips, this is a life-time plier! It will save time and money for years to come. Just replace the tips—never buy a new plier. With both straight tips and angle tips these pliers are versatile, too, and permit easy access in close quarters. Full bright chrome plate, polished nose. This set is a **must** for work on automatic transmissions and power steering. Also has 1001 other uses.

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Herbrand Tools HERBRAND DIVISION
THE BINGHAM HERBRAND CORPORATION, FREMONT, OHIO

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Classes are limited to 25 persons each, to assure each student the proper amount of attention. Lectures, shop demonstrations, and individual participation are combined to make the courses interesting and meaningful.

For reservations write Mr. B. J. Hedger, Binks Mfg. Co., 3122 Carroll Ave., Chicago 12, Ill.

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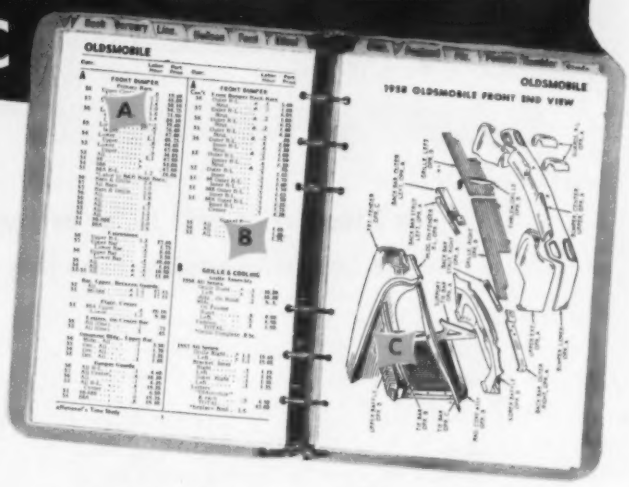

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"So you want to open a service shop?"

It's like leaving home to "go on your own" the first time. Here's "boot training" for the ex-salaried-employe embarking on the tossing seas of independent enterprise.

Part X—*Growing into a Larger Shop*

By HERB CARRIER, Detroit Editor
and
DR. GEORGE A. FIELD, Wayne State University

• AN EFFICIENT, well located, properly managed small repair shop is bound to grow—if the owner wants it to. Owners of some profitable small shops prefer to stay small. They realize that increased size means increased headaches. They don't want to build an empire, they just want a good going business that makes them a comfortable living.

For owners with this basic philosophy, increasing the physical size of their operations is less than desirable. Obviously they have reached a goal, and any further expansion is no particular gain. They have built a business of which they can be proud, and with which they are happy. For them, congratulations are in order for doing what many millions of American males dream of doing, but fail to do for lack of whatever it takes.

Owners of other, comparable small repair shops can't wait until they can grow, and grow and grow. They represent the true empire builders. Super-size corporations of today were once the dreams of individuals who had small businesses. What has been done before can be done again, and maybe better. The owner-operator of any small repair shop can get just as big as he wants to. **BUT** it takes work, planning, organization, and management techniques. Is it worth it? Well, if you were the major stock holder in General Motors Corporation you'd probably think so.

GROW IN ALL DIRECTIONS

To grow intelligently, a small shop must expand in all areas which influence business and business management. The good management techniques of running the small business must be retained where practical. New techniques pertinent to the successful operation of a large business must be learned and applied.

One of the first items to be considered is an effective and workable accounting system. In a small one man repair shop, the cash register is sometimes the hip pocket of the owner-operator. For a small shop, this **might** work. For the larger shop, it just isn't good business. An efficient accounting system is needed.

Few owners of automotive repair shops are capable of setting up their own accounting systems, which requires specialized education and experience. The only reasonable thing to do is to call in an expert in the field. There are ways, however, by which the cost of professional help in this area can be held down to a justifiable figure. For instance, it's sometimes possible to get a part-time man to come in and do the work periodically. Working accountants are alert to the best ways of doing things. In a relatively short time, one of them can tailor an accounting system directly to your business. In the end you'll wind up with a custom job.

Another good thing about having the work done piecemeal is the slow break-in you allow yourself. You'll have time to become acquainted with the system before the accountant has finalized the entire project. This is a big advantage. You'll be completely familiar with the bookkeeping end, and have the opportunity to suggest adaptions that make the system more workable and understandable for you. The part-time accountant can offer service which should prove satisfactory until the business gets large enough to support a full-time office manager.

Bookkeeping services are also available on a once-a-week basis, or whatever schedule you prefer, which will pick up your gross sales slips, accounts receivable, debits, etc., and do the job for you. This service is reasonable and accurate; however, it's not the custom job the accountant would do for you. It's necessarily a little slower than having the work done

and kept up-to-date daily. There are many instances where bookkeeping service is well worth while, and many successful businesses use them.

College accounting students can also do a good job of setting up and maintaining bookkeeping systems for growing businesses. Many times, their youth and vigor overcomes lack of experience. Then, too, the mere fact that they haven't been well-steeped in standard systems can lead to a new and fresh approach in handling your particular problem. In addition, a student can always get help from his professors on any questions that might stump him momentarily. So, in effect, you get the services of a student and a teacher for one very reasonable salary.

GUARD AGAINST EMBEZZLEMENT

Whichever services you employ, make sure you have your books checked periodically by a certified public accountant. Many supposedly honest bookkeepers and accountants have retired at a remarkably early age due to the trusting nature of their employers. This is not to say that those who keep records are any more or less honest than those who do not, but temptation and opportunity are major considerations.

If you employ a full-time bookkeeper, insist that he or she take two weeks vacation each year. Having an outsider take a good long look at the books each year is a form of insurance against embezzlement.

Expanding business automatically means increased operating costs. A good bookkeeping system should include a method for controlling expenses. By clear and concise entries in the expense control column, you can regularly analyze just where the money is going.

Accurate, running records will enable you to make cost-saving decisions based on long-range past performance. For example, it may be better for you to buy a used automatic washing machine than to pay laundry service. Hand towels, shop towels, fender covers, etc., require no pressing or ironing. A quick dunk in a washer-dryer can keep you on top of a good share of your laundry problems. You can't really decide whether to buy equipment or service until you have records to show what kind of money you spend for laundry over a period of several months.

Watch telephone, heat, and electric bills. Make sure the increased utility costs are in proportion to increased gross receipts. If it costs three times as much for utilities, but your gross profit doesn't increase proportionately, it's very possible you are losing money by expanding. Only an accurate expense control system can give you this type of information. It's important to keep a sharp eye on operating costs.

When you are bigger physically, it's logical to assume more repair jobs per day. Consequently, more parts and materials will be used. How much more? Only efficient record keeping will tell you.

Several inventory control systems are available. The most popular consist of index cards filed in a large table-cabinet, or in a specially designed rack. The parts departments of automotive dealerships often use "Kardex," or "Assort-O-Post" systems. It's recommended that careful attention be given the selection of the system. Look over all of them, and select the one that fits your particular setup best.

A good inventory control system will tell you at a glance how many pieces of a given part you have in stock, where the part is stored, how many are on order, and how many have moved in the last six months. Properly operated, such a system can streamline parts inventory by enabling the parts buyer to order intelligently. A high inventory of slow moving parts is just as expensive as a low inventory of fast moving parts. In one case, storage costs eat up the profits of eventual sales, and in the other case, reduced profits result from the time and money spent in chasing parts, or waiting for parts to be delivered.

Effective inventory control will tell you what to order—on the basis of present stock and past rate of sale—help prevent over and under stocking, reduces

Brake reline shops are one of the newest areas for specialized expansion. Utilizing production line methods, there's a chance to corner the local replacement market.

Alert shops "ride the crest" of trends in the automotive field, one excellent means of building the business volume to justify expansion. This establishment capitalizes on nation-wide emphasis on replacement mufflers, to develop specialty work.

stock obsolescence, make maximum use of shortage space, prevent shop down-time, and reduce parts chasing. Certainly, with all these advantages an inventory control system is a good investment.

Unfortunately, any system is only as good as the person who operates it. To be of any value, an inventory control system must be regularly and accurately maintained. If your parts volume warrants a control system, the system warrants an efficient operator. Consider hiring a girl for this job. Usually they are much better at the detailed work required. It's not necessary to have a knowledge of mechanics or parts in order to operate the average inventory control system successfully.

PERSONNEL MANAGEMENT

To operate on a grander scale, you need more bodies. This involves dealing with people on an entirely different level than in the one man shop. People are more fun than anybody, but they can cause more trouble than anybody. Handling people —especially employes—so as to get the most out of them requires constant practice of all the known virtues, and a few natural instincts that aren't easily identifiable.

Hiring the right kind of people makes the job of handling them much easier. As a guide, get a good, standard interview form. A friendly printer, a university psychology department, or a local employment specialist represent likely sources for such literature. Adapt the standard form to include any questions you feel might help you know more about how the prospective employe will fit into your specific business.

Then take the form you have developed to a printer, and have him run off a small quantity for you. Here, again, watch prices and consider alternate methods of getting the same results. If you have a daughter who is taking a business course in school, she might well be able to make perfectly acceptable copies on the school's mimeograph. Maybe a wife who is the secretary for your church could do the same thing, or the lodge brother, etc. It's poor business to sacrifice quality for the sake of saving a few dollars, but in the case of typeset or mimeographed interview forms that are for your use alone the mimeograph or ditto machine quality is perfectly acceptable.

The personal interview and the formal application are the two basic steps for screening future employes. It's often wise to go a step further before making a final decision. You will, of course, call or write the personal references and the former employers listed by the applicant. It goes without saying that this is a very important part of the hiring procedure. The little extra step is to run a check through a credit company. In most cases, you'll have to pay about $4.50 or $5.00 for the service, but it's a good investment in avoiding hiring misfits and persons of questionable habits.

Once the applicant becomes an employe, stick with him. If you have done an intelligent job of screening and checking, forget that stage and concentrate on making the new man an integral part of your operation. Develop a systematic policy for promotions and incentives, and follow it to the letter. Let your men know where they stand. Treat them fairly. Let them know they are appreciated. Tell them how necessary they are to the success of your entire operation.

This isn't coddling; it's good business. An employe who feels that he's getting a fair shake is an employe who will give a fair day's work. And you're certainly not exaggerating when you emphasize the worth of a good employe. Getting the right people to work for you can be one of your biggest headaches in operating a large repair business.

ADVERTISING

As you grow, you should increase your advertising budget, regarding it as an investment rather than an expense. You'll never be sure whether you're growing because you are doing more advertising, or if you are doing more advertising because you are growing. They are that close together. You must advertise to grow, and you must grow to afford the cost of increased advertising.

The number of dollars spent for advertising do not necessarily indicate its effectiveness. Budget your advertising dollar wisely. As you get into various types of advertising, investigate the services offered by an advertising agency. Probably by the time you are ready to work with an agency, you will have been approached by several. A good agency is worth its weight in gold.

In addition to advertising, you'll need publicity. A newspaper reporter—on the staff or in business for himself—can do tremendous good for a growing business. They're not easy to come by, but if you can get one to work for you, the rate of growth your business will experience will astound you. If advertising were a cake, publicity would be the frost-

Small shops doing lots of engine work can logically expand into volume installation of rebuilt engines and transmissions; or into engine rebuilding as a specialty.

ing. And what fine dessert they make in your menu for successful growth!

AREAS FOR EXPANSION

In today's business world, a company will seldom "just grow." Growth is no accident. It's a carefully planned, carefully executed procedure. A small automotive repair shop interested in expanding has a very fertile field in which to plant seeds. Too often the owner-operator of a small shop views expansion as the addition of a stall or two and the hiring of a couple of mechanics to do the same kind of work he is already doing.

He hopes, of course, the increased space and manpower will result in increased business and more gross income. This isn't bad. In fact, it's a natural. There's really no reason why a successful small shop can't become a successful large shop. However, there's also no good reason why it can't become a successful large something else.

For example, an automotive franchise is not out of the question. Many very large dealerships started out as very small repair shops. Their owner-operators wanted to expand, but didn't want just a bigger repair shop. Their repair facilities and their knowledge of the automotive field became the nucleus around which they built a much bigger business.

Wonderful opportunities exist today for the alert repair shop. Boats and mobile homes are enjoying increasingly greater sales. Expanding an automotive repair business to cover these comers is well within the realm of reason. Boats have motors not unlike cars, and mobile homes have wheels, brakes, etc., that require periodic service.

Car leasing is another business that is coming in like a lion. Who is in a better position to offer cars for lease than a shop that is adequately equipped with machinery and know-how to keep the cars running properly and without excessive spending for repair and maintenance? It's estimated that within ten years, more than half the vehicles on the road will be leased. Thousands of persons will be in the leasing business. The energetic owner-operator of a repair shop is in a spot to slip in like a burglar.

For those who prefer to stick strictly to the nut and bolt side of the business, the future looks just as rosy. More and more cars and fewer and fewer mechanics can't help but mean increased work per shop. The largest and best shops will naturally get the biggest share of the repair business. Carefully planned expansion will result in profitable growth.

However, this is the age of specialization. No one goes to a general practitioner any more. It's much more fashionable to take your aches and pains to a specialist. So it is with today's car owner. When he needs a tune-up, he goes to a tune-up shop; a wheel alignment, a front end shop; and so it goes. The cue, of course, is to specialize. This can be done by expanding into a specialty shop, or by expanding by adding a specialty department.

If you have been running a small general repair shop, consider adding a bump and paint annex, or a glass replacement department, or a front end department. Your experience in turning away work for which you were not equipped can be your expansion guide. If you have been sending customers down the street a mile or so to have front end work done—and have been forced to do this with embarrassing regularity, you know the addition of a front end machine is a logical form of expansion for you. This same reasoning applies to other areas where you are passing up too much work.

Another possibility is to expand geographically. Opening up a second small shop would not be much different than opening the first one. If you can do it once, you can very likely do it again; and the second time should be easier because you have "been there before." If you are ambitious and capable—and you must be to successfully build your own business—you could wind up with a string of repair shops. Men have done it with cigar stores and shoe repair shops. It is possible with repair shops.

Growth potential for a successful small repair shop is literally gigantic in not one, but several related areas. If you want to grow, you can. How big can you get? It's up to you. The thrill and excitement you experienced when first starting your business can only be repeated through constant expansion. If you are a builder, you'll expand. If your business is only a means to an end, you'll probably be happiest staying small. Either way, you'll be your own boss—and the envy of millions of men.

Sticky Pump Relief Valve Can Immobilize Ultramatic

In the event the Ultramatic transmission used on most Packard straight eight models (prior to gear start type) ceases to function or drive in any forward position of the selector lever (but *will* operate in reverse), the Studebaker-Packard Service Department states the malfunction may be due to the front pump relief valve sticking in the bore of the housing.

This valve is located in the lower rear part of the flywheel housing just ahead of the attaching flange of the transmission housing, and may be removed after removing the relief valve retainer plugs at each end of the relief valve bore.

Should repeated sticking occur, in spite of careful cleaning and freeing-up of the valve, the factory states that it may be necessary to install a new flywheel bell housing.

Chrysler Stresses Need for Lubricating Body Hardware

A recent Chrysler Service Bulletin stresses the importance of correct lubrication to provide satisfactory body hardware operation.

Of particular importance is the lubrication of the inner lobes of the door lock rotor to prevent sticking mechanisms, rotor freeze up, and other lubricant-related conditions. To facilitate lubrication of the inner lobes of the rotor, Chrysler provides a rotor access slot through which "MoPar Lubriplate" should be applied, with the door handle in the extreme open position. Rotate the rotor and work the handle back and forth as lubricant is applied so as to allow the door lock cams to contact the inner rotor and in so doing, come in contact with the lubricant.

Other parts to be serviced at frequent intervals, but often overlooked,

Seven Secrets to Success

(more than 100,000 mechanics are proving it everyday)

I-R ELECTRIC IMPACTOOLS

—to save you time and money in nut-running, drilling, reaming, tapping and dozens of other expensive "hand" operations.

SIZE 2U
(Heavy Duty) ⅜" Drive
Actual case histories show that this real multi-purpose Mighty-Mite pays for itself in 90 days.

SIZE 4U-SD
(Standard Duty) ½" Drive
Makes the toughest jobs easy and adds up to 25% to your service capacity. Cuts nut-running time by 90%.

NEW **SIZE 5U-HD**
(Heavy Duty) ½" Drive
Packs extra power and greater speed for the big and little jobs alike. Lighter and easier to use, in spite of increased power.

SIZE 5UT
(Heavy Duty) ½" Drive
Precision torque control with automatic shut-off helps you handle even the toughest nuts on high compression engines, quickly and safely.

A free demonstration of these tools at work *in your shop* will convince you. Call your I-R jobber today for full information about I-R's complete line of electric and air Impactools designed especially for automotive service.

18-908

are: door check arm; fuel tank cover hinge; deck lid lock; hood hinges and hood locks; and on station wagon models, the tail gate hinges, locks, striker plates and dovetails.

Willys Cautions Mechanics On Oil Seal Replacement

Care must be used in installing the oil seal in the timing chain cover on Willys 6-226 engines and in installing the cover on the cylinder block. If care is not used, the seal will leak after installation.

When installing a new seal, the factory recommends that the cover be braced so that the oil seal opening flange is firmly flush on a flat surface. Apply a thin coating of sealing compound around the outer edge of the seal and place the seal in the opening so that the seal lip faces toward the inside of the cover. Drive the seal in place with a suitable driver. This method of installation will prevent cocking the seal. Lubricate the seal after installation.

Before installing the timing chain cover on the block, place an oil seal installing sleeve on the front end of the crankshaft. The sleeve serves as a guide in locating the cover on the block and prevents seal damage.

Chrysler Changing Rear Axle Ratios

Chrysler advises that a new rear axle ratio (2.89:1) is being manufactured concurrently with the 2.93:1 axle ratio for use on its 1959 Chrysler and Imperial models. Both of these axle ratios will be used in production for an indefinite period with the 2.89:1 eventually replacing the 2.93:1 ratio.

The two ratios are completely interchangeable, along with all component parts, including the carrier assembly. Therefore, if for any reason parts are needed for the 2.89 ratio, use the parts listing for the 2.93 ratio.

in Automotive Service . . .

AIR IMPACTOOLS AND IMPACUTTER

are light, compact and powerful—designed especially to save time in auto service shops—and to cut costs.

NEW **SIZE MC121 AIR IMPACUTTER**

The modern way to cut or drive out bolts or rivets, scrape undercoating and paint, cut or split sheet metal, mufflers and tail pipes. Built for years of dependable service, this rugged new tool can save you up to 90% of the time formerly required for the roughest body shop operations. It's also hard to beat for dismantling wrecks or cutting up junk cars.

SIZE 402 AIR IMPACTOOL, ⅜" Drive

The smallest pistol grip power wrench on the market, and one of the most useful. Calibrated so you can get the power you want for any job.

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Weighs only 5 lbs., but handles all but the largest nuts. Compactly designed for close-quarter jobs and to reduce fatigue.

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Originators of Impactools . . . Air and Electric

18-908-1

By HERB CARRIER
Detroit Editor

Fuel control systems

Converting liquid gasoline into mechanical energy involves more than carburetion. Air filters, manifolding and exhaust systems — all play an equally important role in providing efficient, economical engine operation from tank to tailpipe under constantly changing conditions.

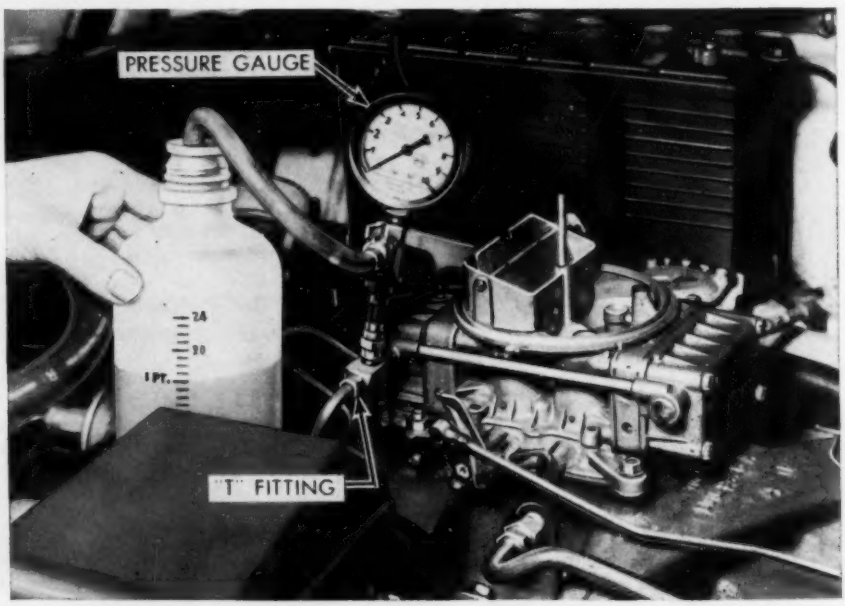
Part IV—Fuel Pumps

● AN INTERNAL COMBUSTION ENGINE operates under many variable conditions. The demands of an average automobile engine are constantly changing even under normal driving conditions. Under "Carburetion," we discussed how the carburetor metered fuel to the engine to satisfy its wide range of demands. Most modern carburetors do an efficient job of handling the metering task *IF* they have a constant, adequate supply of fuel in their reservoirs. It is the job of the fuel pump to provide that supply.

In the early days of automotive engineering, gasoline flowed to the carburetor fuel reservoir by means of gravity. Recall the early Fords? They had the main gas tank located in the cowl above the level of the carburetor. As long as the carburetor needle valve was open—and the gas tank cap was properly vented—fuel would flow from tank to carburetor without aid of any vacuum, mechanical, or electrical device.

As cars became more complex, the fuel tank wound up as far from the engine as possible, and various means of fuel transport were introduced. In some instances, the fuel tanks were pressurized. Air pressure on top of the fuel in the tank would force gasoline from the tank to the carburetor. This was an efficient delivery system, but the task of maintaining constant air pressure in the tank usually involved an engine-driven compressor complete with the necessary controls. In addition, a hand-operated primer pump was required to permit pressure build-up after the engine had been idle long enough that compressed air had leaked out of the tank.

Another attempt to solve the fuel delivery problem involved the use of a vacuum tank, or tanks. These were mounted in the engine compartment. Three connections were used: one to the main fuel tank at the rear of the vehicle, one to the carburetor, and one to the engine's intake manifold. In operation, vacuum was created in the tank by the engine via the intake manifold. Fuel was forced by atmospheric pressure from the main tank into



Fuel pumps should be checked for volume and pressure. Most manufacturers recommend a specific amount of fuel to be pumped within a specific space of time. Occasionally, fuel pump vacuum must be checked to make sure the pump has sufficient "pull." However, if volume and pressure are within limits, vacuum usually is normal.

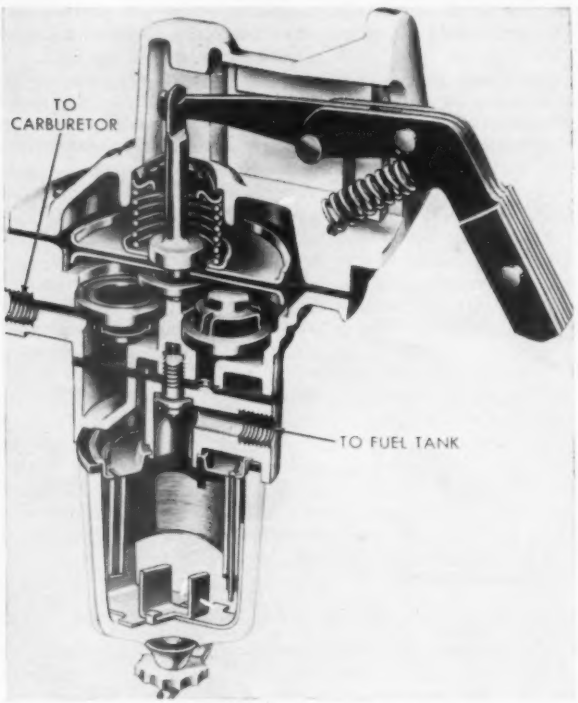
the vacuum tank. From the vacuum tank, it was gravity fed into the carburetor. This system of fuel delivery also worked quite well, but it, too, had a relatively short life as engines increased in size and speed.

DIAPHRAGM MOST EFFICIENT

Through engineering improvements, and just plain trial and error, the fuel delivery problem was solved most effectively with the development of the diaphragm-type fuel pump. In this system, fuel is actually pumped from the fuel tank into the carburetor reservoir by a simple, dependable, long-lived mechanical device. No longer is it necessary for an automobile engine to depend upon gravity or vacuum for the fuel it burns. It's true that the diaphragm-type fuel pump takes advantage of a pressure differential, but it is generally thought of as a mechanical pump, rather than a vacuum pump.

CONSTRUCTION

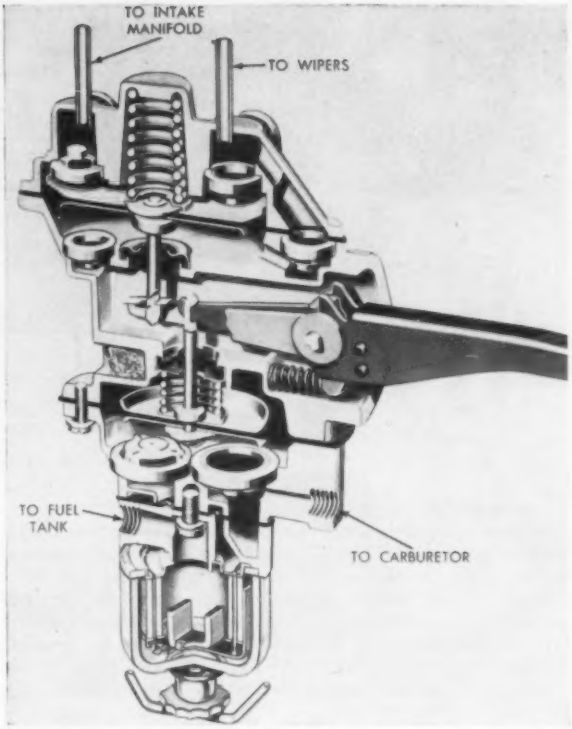
A typical diaphragm-type fuel pump consists of a metal body, a rubber diaphragm, actuating linkage,



Cutaway of single-action fuel pump. Note the position and size of the inlet and outlet valves, also the metal assembly inside the sediment bowl. The upper element in the bowl is the gasoline filter; lower element a magnetized piece of metal. This is used to catch and hold all metallic bits of foreign matter in the incoming gasoline.

valves, springs, gaskets, and ordinarily, a glass sediment bowl complete with strainer or filter. The metal pump body provides a working housing for the diaphragm, lever, valves, and springs. Most all modern fuel pumps are mounted on the engine, and are actuated by a camshaft eccentric.

Many fuel pumps of this kind have an air dome cast into the metal cover. The purpose of this dome is to relieve the carburetor needle valve and the fuel pump diaphragm of excessive pressure when the carburetor needle valve is closed. Also, the air dome principle



Cutaway of double-acting fuel pump. In this typical design, the upper section of the pump is the vacuum booster; lower section the actual fuel pump. Each section has its own diaphragm and valves. Only one lever is used to actuate both diaphragms.

utilizes this pressure to increase its delivery rate about 25 per cent. Air domes are in common use on various kinds of hydraulic pumps.

PUMP OPERATION

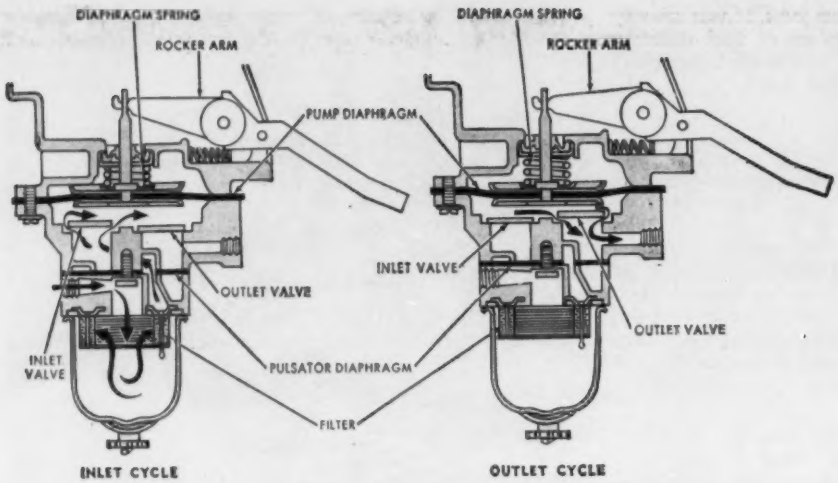
The one basic action of the fuel pump is the reciprocal motion of the diaphragm. Usually, this motion is in the vertical plane. An actuating linkage is used to force the diaphragm in one direction (most often "up"), and springs are used to force the diaphragm in the opposite direction ("down"). Small, disc-type valves control the flow of fuel to and from the pump. Average diaphragm stroke length is seldom more than ¼ of an inch.

Tracing typical pump operation from the beginning, the camshaft eccentric forces the diaphragm upward against spring pressure. This action creates a partial vacuum in the pump chamber. Fuel from the main tank is literally forced into the low pressure pump chamber through the open disc valve. The incoming gasoline supplies the force necessary to open the valve, which is little more than a one-way check valve.

As the engine camshaft continues to rotate, springs force the diaphragm downward as the actuating linkage follows the camshaft eccentric to its low spot. The downward action of the diaphragm closes the intake valve and forces fuel to the carburetor reservoir through the pump outlet valve. Both intake and outlet valves are similar in construction and operation. That is, they are both one-way check valves and are opened and closed by fuel flow. No mechanical components are required in the control of valve operation.

Fuel is delivered to the carburetor only when the float needle is off its seat. When the liquid level in the reservoir is high enough to force the needle against its seat,

(Continued on following page)



In operation, the diaphragm of the single-acting fuel pump rises and falls as the actuating lever follows the camshaft eccentric. Just a slight motion of the diaphragm is necessary to draw in fuel from the main supply tank and pump it to the carburetor fuel reservoir. The pump valves operate as one way check valves to permit the fuel to flow in and out of the pump.

pressure builds up in the air dome—or similar feature—and causes the diaphragm to stop pumping. In this position, the pump is said to be balanced because the pressure in the pump to carburetor line equals that of the diaphragm spring. In this way, fuel from the pump to the carburetor is always under pressure. The amount of pressure varies according to pump design, but is usually somewhere between 3½ to 6½ lbs. p.s.i.

As the carburetor uses gasoline, the float drops to pull the needle valve off its seat. Pressure in the pump immediately drops as fuel is delivered to the carburetor reservoir. Almost instantly the diaphragm again starts operating to pump more fuel. The diaphragm can start and stop many times per mile of vehicle operation, but the pump actuating linkage is always in operation as long as the engine is running.

Some fuel pumps incorporate a pulsator and pulsator chamber, to dampen the effect of pump pressure pulsations on the carburetor needle valve. This is desirable to prevent high fuel level in the reservoir due to the needle being jarred away from its seat. Also, high fuel level affects operating economy in that it usually results in an over-rich mixture.

The actuating linkage has its own spring to insure contact of the lever to the eccentric at all times. If this spring is broken or weak, the lever tends to float, causing excessive noise and eventual breakage of a metal component.

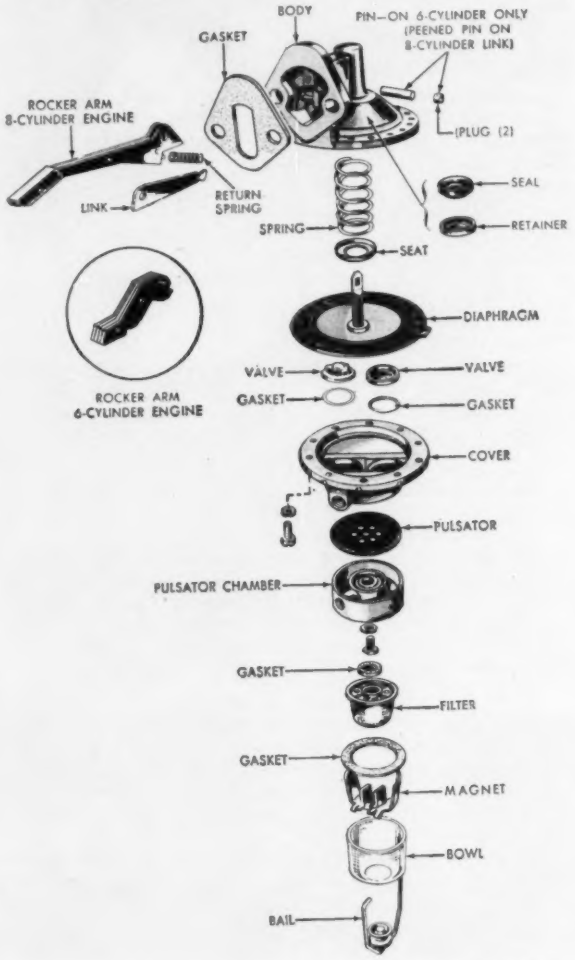
VACUUM BOOSTERS

Pumps used for fuel delivery only are called *single action* pumps. However, many fuel pumps currently in use in automotive vehicles are designed to pump fuel and to assist in the operation of vacuum-type windshield wipers. These are *double action*, more commonly referred to as *vacuum booster* pumps.

In construction and appearance vacuum booster pumps resemble two single action pumps placed one above the other. In effect, they are exactly that. Usually, a single operating lever is used to actuate two separate diaphragms. One diaphragm is part of a fuel delivery pump, and operates in accordance with the foregoing description. The other diaphragm is part of the vacuum pump which operates as follows:

As the actuating lever forces the diaphragm upward against spring pressure (the operating components of the vacuum booster are almost identical in principle to the components of the single action pump), air is forced through the outlet port into the engine's intake manifold. On the return stroke, spring pressure forces the diaphragm downward, creating a partial vacuum and opening the inlet valve. In this manner, air is pumped out of the windshield wiper motor and into the intake manifold.

Parts layout of typical single-acting fuel pump. As the detail inset indicates, there is a difference between the actuating lever (rocker arm) used on six-cylinder installations and that used on the eight-cylinder installations. Otherwise the pumps are identical.



When the wiper motor is shut off, manifold vacuum holds the diaphragm against its spring so that the full motion of the actuating lever is not accompanied by a complete up-and-down motion of the diaphragm.

When the windshield wiper motor is turned on, but manifold vacuum is greater than the vacuum created by the booster pump, air flows from the wiper motor through both valves of the vacuum booster. In this instance, the operation of the windshield wiper motor is as though the fuel pump is a single action rather than double action. On the other hand, as manifold vacuum drops off, due to the engine operating under low speed and high load, the vacuum created by the vacuum booster will be greater than engine intake manifold vacuum and the pump will operate the wiper motor when the wiper control switch is turned on.

DIAGNOSING PUMP TROUBLES

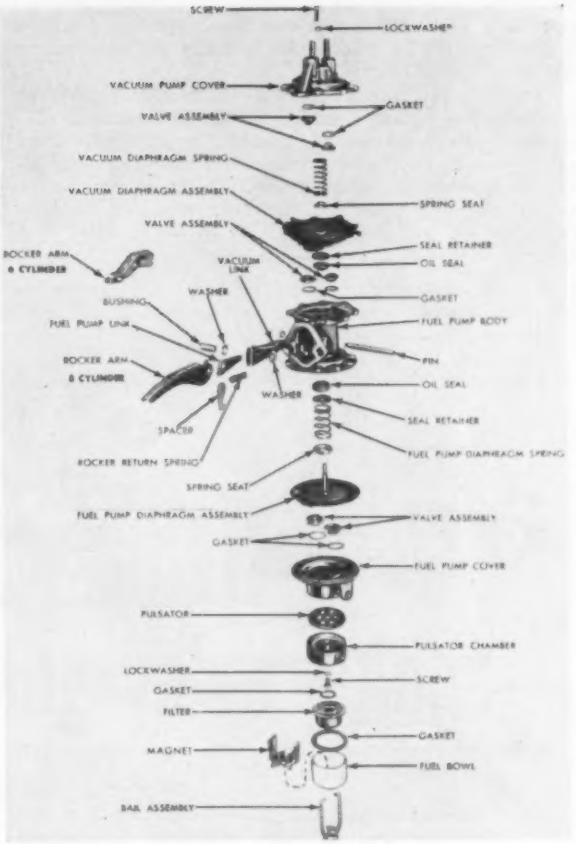
Viewed in the light of the thousands of miles of trouble-free service they perform and the thousands of gallons of gasoline they pump, modern fuel pumps are among the most dependable of all engine accessories. But, being hard working mechanical devices, they do occasionally require repair and/or replacement. Replacing a worn out fuel pump, either single or double action type, is a simple mechanical operation. Usually only two bolts or cap screws are used to attach the pump to the engine block. Disconnecting the metal fuel lines, and removing the rubber hose connections to the vacuum booster (if used), plus removing the pump attaching bolts, allows the pump to be lifted from the engine.

In servicing fuel pumps, the major problem is to determine if they are working properly. This involves careful testing and intelligent interpretation of test results. Pumps are designed to deliver a certain amount of fuel at a certain pressure. These readings are taken from the outlet side of the pump. Another important specification indicates the pump's "pull." This reading is taken at the inlet side of the pump.

Volume Check: The amount of fuel the pump delivers in a given time period is called the pump's capacity. To measure it, disconnect the fuel pump-to-carburetor line at the carburetor end. Place the open end of the line in a suitable container. Start the engine and operate at normal idle speed. A typical specification is delivery of 1 pint of fuel into the container within 20 seconds. This is only a representative spec; manufacturers literature should be consulted when checking out a particular make and model.

Pressure Check: If the volume of fuel is within limits, the fuel pressure is checked. For this, the disconnected line is removed from the container, and a suitable pressure gauge is plugged into the open end. Many manifold vacuum gauges are calibrated so that they can be used to record fuel pump pressure. With the gauge properly attached, the engine is again started. Some manufacturers recommend checking fuel pump pressure at idle speed only. Others recommend checking pressure at idle and at all speeds up to near wide open throttle. Be sure to double-check manufacturers specs when testing pressure on any specific fuel pump.

Vacuum Check: Almost as important as the pressure and volume checks, is the vacuum check. Ordinarily, though, if a pump will deliver the recommended volume of fuel at the recommended pressure it can be assumed to be operating within design limits. To run a vacuum check, reconnect the fuel pump to carburetor line, and disconnect the fuel pump-to-fuel tank line at the fuel pump. Attach a suitable vacuum gauge to the inlet side of the pump. Start the engine and run at idle. A typical permissible gauge reading is 6 in. (mercury); but, again, check manufacturers specs for particular make and model.



Typical parts layout of a double-acting fuel pump. Note the similarity of components between the fuel section and the vacuum section. The diaphragms appear identical as do the valves and the springs. This particular pump has a pulsator in the fuel section to relieve excess pressure for the needle valve in the carburetor float assembly.

Vacuum Booster Check: To test the condition of a vacuum booster pump, disconnect both inlet and outlet lines at the pump. Attach a vacuum gauge to the windshield wiper connection at the pump. Start engine and operate at 2000 rpm. A typical permissible gauge reading is 10 to 14 in. (mercury). This specification, too, should be checked with specific manufacturer recommendations.

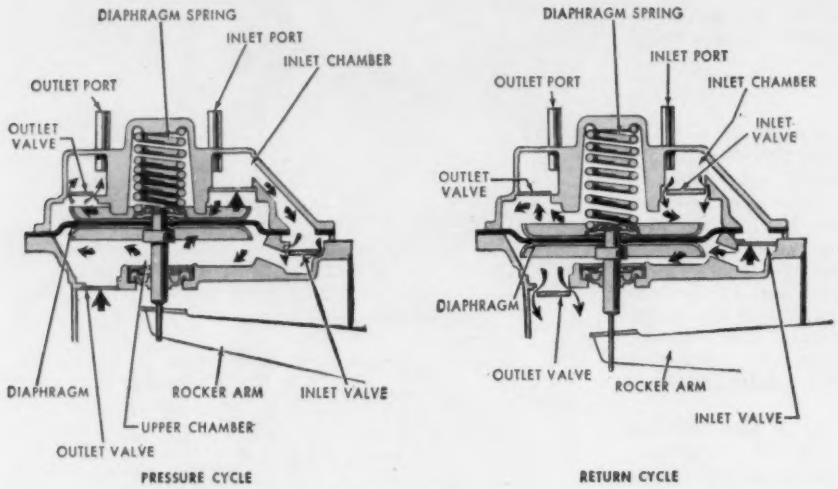
Should the results of any of the foregoing tests not be within limits, tighten the pump connections securely and inspect all lines visually for cracks or breaks. The fuel pump sediment bowl should be removed and cleaned; the line to the main tank blown out with compressed air to make sure it is free of obstructions. When blowing out the line, be sure to remove the fuel tank cap to prevent pressurizing the systems and causing dangerous spillage of raw gasoline. Pump mounting bolts should be securely tightened to make sure the holes in the casting are not elongated enough to allow the actuating lever to work the entire pump assembly up and down, rather than just the pump diaphragm.

If these measures do not bring the pump within specifications, it must be removed for overhaul or replacement. Because new and reconditioned pumps are available at moderate prices, it is seldom economical to

undertake extensive pump overhaul. However, pumps can be repaired by most shops without the purchase of elaborate equipment.

Available repair kits supply all the necessary parts for satisfactory overhaul. Usually, these kits consist of diaphragms, valves, springs, and gaskets. Installation of these parts poses no particular problem to a mechanic who includes cleanliness and good work habits, automatically, in the overhaul procedure. In most instances, expertly reconditioned pumps are available at lower costs than justified on-the-spot overhaul charges.

Fuel pressure regulators are other accessories that many consider important enough to be standard equipment. They apparently have a place in the picture. Today's fuel pumps can develop pressures as high as 3 to 4 times as much as that required for normal driving conditions. Some fuel pumps can put out as much as 10 to 12 lbs. of pressure. Then too, this pressure tends to be in pulsations rather than steady, even flow. High, pounding pressure can literally wallop the float needle off its seat and admit enough fuel to raise the level in the carburetor reservoir sufficiently to cause raw fuel to be slopped into the intake manifold. This in turn, can cause surging, flooding, stalling, and general rough operation.



Air flow in the vacuum section of a double-acting fuel pump is similar to the fuel flow in the lower section. A diaphragm is used to create the pumping force which literally pumps air out of the windshield wiper motor into the intake manifold. When the wiper motor switch is turned on, the intake manifold vacuum is less than the vacuum created by the vacuum booster.

About the only competition to the diaphragm-type fuel pump is the electric pump. Many advantages are claimed for the electric over the mechanical. For one thing, the electric can be mounted on the vehicle frame away from engine heat, good insurance against vapor lock in warm weather. Another thing is that an electric pump starts to work the instant the ignition key is turned on. This can be a big advantage in starting engines that have been standing for comparatively long periods. An electric pump is also a little more pressure sensitive than a mechanical pump, a feature tending to reduce carburetor flooding and loading up.

Electric pumps can be a valuable equipment on many installations. However, the initial cost of replacing a standard-equipment diaphragm pump with an electric unit is often an obstacle, unless the customer wants the ultimate in car performance. To the perfectionist and for many commercial applications, electric fuel pumps are worth the extra cost.

"Back pressure" is another nasty habit of some fuel pumps, which a pressure regulator helps to eliminate. When a car that has been traveling along at a pretty good rate of speed is suddenly stopped, fuel in the pump-to-carburetor line remains under heavy pressure. In many cases, this "back pressure" is sufficient to force the needle off its seat and, again, lead to all the troubles caused by excess fuel in the combustion chambers.

There are some efficient pressure regulators on the market, and there are some duds. A dud may regulate the pressure, but it can also reduce fuel pump pressure to where the engine operates under a starved condition. The result, of course, is reduced power and speed, reduced acceleration, and, last but not least, burned valves. If a pressure regulator is called for, don't hesitate to recommend and install one; but make sure it is a quality product that is properly engineered to do the job.

Noisy Truck Transmission Due to Gear Interference

If a condition of noise is encountered on Dodge Truck 420 4-speed transmissions when engaged in third or direct gear, the factory suggests that it may be due to the low and second speed gear striking the countershaft.

To correct this condition it is recommended that shims be installed between the countershaft drive gear and the countershaft front bearing to move the countershaft rearward. When doing this, however, care must be used to not shim excessively rearward in order to avoid interference of the rear face of the countershaft drive gear and the outer synchronizer stop ring.

Proper positioning is obtained when the clearance between the low-second speed gear and the countershaft is equal to the clearance between the counter shaft drive gear and the synchronizer stop ring.

Disconnect Vacuum Tube When Setting V-8 Timing

On late 1958 Chevrolet passenger car V-8 engines used with automatic transmissions, distributor vacuum advance signal is taken directly from the intake manifold rather than through drillings in the carburetor throttle body. This produces a greater spark advance at idle which results in improved engine cooling.

On these later engines with the distributor vacuum tube connected directly into the intake, Chevrolet advises that it is necessary to disconnect the tube from the vacuum source when setting engine timing. With the line disconnected set ignition timing at 4°BTDC at idle. With the vacuum line re-installed, after timing, engine advance will probably be with the limits of 17°-21° at idle.

Servicing the Porsche . . .

(Continued from page 29)

both barrels tuned to a "gnat's eyelash."

Setting the *mixture* with precision has probably upset the original idling *speed adjustment*. So the last step is to recheck and if necessary reset the idle speed.

No owner likes to have a mechanic run his engine as though it were about to take off, yet it is good business to kick the engine once or twice to see if there is any inclination to stall on sudden deceleration.

ELECTRICAL CHECKS

Since only a good electrical system will keep a tune-up performing satisfactorily, a look at the battery and regulator is in order.

The battery is well mounted—and well hidden—right under the front edge of the front hood. To make things more interesting, the spare tire (which has been la'd back in Fig. 11) is strapped down over it. Battery hold-downs are a couple of spring clips.

The usual precautions of keeping the battery terminals clean and tight apply "double" here because of the long path through which the current must flow—from the front of the car to the rear. Properly maintained this system works excellently.

The gravity values to which the Porsche battery is balanced are as follo vs:

Full charge—1.285
Semi-charge—1.230
Discharge—1.142

In addition to keeping connections at the battery clean and tight it is essential to keep the connections at the generator and regulator clean and tight.

Note in Fig. 12 that the white wire on the base of the regulator being tightened by the mechanic leads directly to the frame of the generator. This ground wire is as important to proper regulator action as are any of the other wires. As a finishing touch on any tune-up it's good insurance to see that *all* are clean and tight.

The generator belt tension is correct when light thumb pressure near the center deflects the belt ⅝ in. to ¾ in. Tension is adjusted by spreading or narrowing the width of the "V" of the generator pulley.

The large generator pulley nut is shown in Figs. 4, 5, 6, 7, 8, and 10. To take off this nut, hold the generator pulley by wedging a screwdriver between a recess in the inner edge of the pulley and the housing bolt of the generator. A 36 mm. box wrench fits this pulley.

When the nut is taken off nine spacer washers will be noted on the generator shaft at the pulley. As the belt wears or stretches, remove spacer washers from within the V so that the pulley can squeeze up onto the worn or stretched belt. Always place the washers removed from the pulley on the outside of the pulley under the nut for future use.

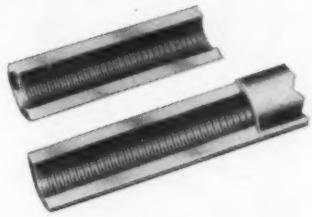
If only one spacer washer remains between the pulley halves, the belt has stretched beyond usefulness and must be replaced. When installing a new belt, put as many washers as possible inside the pulley. But remember that after a short period of use—perhaps 30 to 60 miles—the new belt may have stretched, making it necessary to readjust the tension.

Sports Car Film

"Competition Driver," a new 25-minute color film produced as a tribute to the sport of road racing is available for free showing to local groups. It covers the Watkins Glen Grand Prix Sports Car Races, is highlighted by the *Concours d'Elegance* parade of antique cars, and offers numerous "behind the scenes" looks at the event and the field. Because of its emphasis on driving safety, the film is suggested as suitable for high school driver education classes. Arrangements for showing may be made through the Kendall Refining Company of Bradford, Penna., which sponsored the filming.

YOU CAN MAKE $6.00 in 10 minutes rebuilding valve guides

Exclusive new Kwik-Way Knurling Tool restores both integral and removable valve guides to original ID



This revolutionary new Kwik-Way Knurling Tool can make you $6.00 in 10 minutes. You carry no excessive valve or guide inventory. It eliminates necessity for oversize valves in integral-guide heads. You can rebuild the 12 guides in a 6-cylinder engine to original ID in approximately 10 minutes . . . and do it without removing them from the head or block.

But that's not all. This profitable operation also improves engine performance — eliminates valve sticking and scoring — stops oil consumption due to excessive guide wear!

Make us prove it to you

Let us show you what this revolutionary new Kwik-Way Knurling Tool can do. Simply mail the coupon below. We'll arrange a demonstration for you right in your own shop. No obligation, of course.

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CEDAR RAPIDS ENGINEERING CO.
920 17th St. N.E.
Cedar Rapids, Iowa

OK, prove it to me. Show me how the Kwik-Way Knurling Tool can produce $6.00 extra income in 10 minutes work.

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These are new *manufacturers' products*

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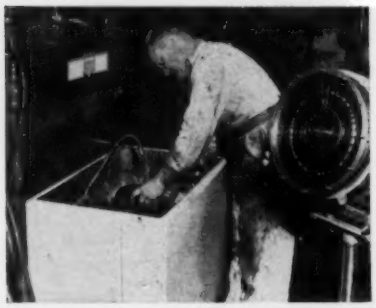
Kleer-Flo Cleanmaster

According to Practical Manufacturing Co., on-the-job testing proves that their Kleer-Flo Clearmaster equipment is ideal for the critical cleaning of automatic transmissions, differentials, and power steering units.

Shops who have long used this



equipment for cleaning such parts as oil filters, air filters, carburetors, fuel pumps, etc., have found that the use of this same equipment shortens considerably the time required to overhaul an automatic transmission or power steering unit with their multitudinous number of parts and their critical cleaning requirements.

Using Kleer-Flo Hi T Degreasol Cleaning Compound, which is said to be fast drying and leaving no film, the Super Cleanmaster Model 50 cleans three ways: Through a continuous flow hose, air agitated soaking tank, and super power jet air gun.

(Circle No. 1 on Reader Service Card)

True Wheel Dynamic Balancer

The True wheel balancer, because of its inherent sensitivity, does not require high rotational speeds, according to the manufacturer, True Balance Co.

Dynamic balancing is obtained after first statically balancing the wheel. The balancer has a static sensitivity of ¼ oz. and a dynamic sensitivity of less than 1 oz. One of the salient features of this unit, the maker points

out, is an automatic marking device which produces a mark on the tire indicating the heavy spot. It will indicate the transfer of ½ oz. from opposite tire walls, maintaining balance or equilibrium at the same time.

The balancer is modestly priced.

(Circle No. 2 on Reader Service Card)

Miniature Lamps in New Packs

Four popular Tung-Sol miniature lamp types (Nos. 1034, 63, 1154 and 67) which are said to fulfill 60% of

service requirements, are now being packaged in easy-to-use, space-saving flat packs. According to the manufacturer, the new pack simplifies inventory, saves shelf space and puts an end to "wobble stocking." The new flat pack snaps open with light thumb pressure.

(Circle No. 3 on Reader Service Card)

Top-Side Mechanic's Creeper

The Grigg Top-Side Mechanic's Creeper makes it possible for mechanics to get at hard-to-reach distributors, carburetors and fire wall mounted controls without being an acrobat

or contortionist. It is easily maneuverable over the fenders of back-opening hoods, or over the radiator of conventional front-opening hoods by means of swivel creepers, and is adjustable to any desired working height up to 52". The "working table" includes a convenient tool tray and a drop light hook. Safety features include non-tilt tripod construction, three mounting steps and hand rails.

(Circle No. 4 on Reader Service Card)

ESS Upgrades Charger Line

Shooting for a bigger share of the automotive service market, Electric Service Systems, Inc. announces a new series of deluxe battery chargers identified as the ESStron line.

Construction features include a pair of long life silicon rectifiers as well as silicone-impregnated glass-insulated transformers—a combination that is said to tolerate much heavier loads

and higher temperatures without burnout.

The charger is rated at 100 amperes for 6-volt batteries or 50 amps for 12-volt batteries and is equipped with a rugged ammeter, push-button control switch and 60-minute timer.

(Circle No. 5 on Reader Service Card)

Choke Tube Kit Merchandiser

A new counter merchandiser, designed for compact, self-salesmanship of Houser's Choke Tube Repair Kit is being offered by the Houser Engineering & Mfg., Inc.

A large, clear illustration on the

"billboard ad" display top shows how the product cures choke trouble in most cars on the road today. Help-yourself literature in a metal dispenser-pocket at the side explains the simple installation of the choke tube replacement.

The compact display, measuring 16" wide by 24" high, is of sturdy, ⅛" pegboard with two metal shelves which are completely assembled and stocked, displaying 24 of the most-wanted choke repair kits for Ford, GM, and Chrysler products.

(Circle No. 6 on Reader Service Card)

Brake Shoe-Drum Arc Gauges

Barrett Equipment Co. announces three new precision Arc Gauges for

checking 10, 11 and 12 inch brake linings and drums.

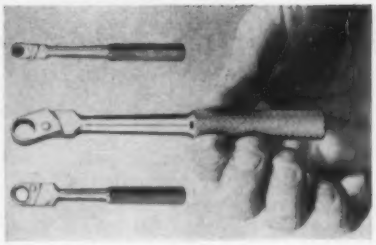
The inner surface of the gauge is used for checking arc ground on new lining, as well as for checking worn shoes to determine need for either standard or oversize lining . . . also ideal for checking accuracy of bench radius grinders. The outer surface of the gauge is used for checking drums to determine need for standard or oversize lining.

(Circle No. 7 on Reader Service Card)

Small Ratchet Wrench

The Milbar Corp. has developed a special small ratchet wrench for close-clearance wrenching operations.

The outside diameter of the wrench head does not exceed the diameter of the head flange on a twelve point screw, which means there is no overlap to interfere when bolting or nut-



ting in tight places. A tool of the same type is also available for hex-head bolts and nuts. The tool can be used for either tightening down or loosening.

(Circle No. 8 on Reader Service Card)

SUNNEN SERVICE TIP

Doing the job is only part of it... Doing it *right* is what counts

There's a Sunnen equipped shop near you ready to fit pins and recondition rods by this widely accepted — and most accurate — method.

Sunnen Equipment . . .

guarantees you factory accuracy on your pin fitting and rod reconditioning jobs. This latest method insures exact pin fits . . . clearance as well as press-fits . . . to a "tenth" by precision gaging the work itself.

Connecting rods, too, should be reconditioned to guarantee proper bearing operation . . . to assure good oil pressure, heat dissipation and eliminate bearing failures. You get your own rods back as good as new.

When you send your pin fitting and con rod work out, specify "Sunnen" . . . it is your guarantee of the best job and trouble-free performance.

There's a Sunnen equipped shop nearby. Visit it and get the facts.

Sunnen Precision Honing Machine, Model LBB-1300 *For precision pin fitting, rod reconditioning, and gaging.*

972

SUNNEN PRODUCTS COMPANY

7914 Manchester Avenue
St. Louis 17, Missouri
Canadian Factory: Chatham, Ontario

WORLD LEADER IN HONING ACCURACY

These are new *manufacturers' products*

Ratchet Repair Kits

Complete repair parts for ¼", ⅜" and ½" drive Proto reversible ratchets are now available from Proto Tool Co. in kit form. Each kit contains a wheel-plug, two dogs, a lever, a cam, 2 springs, a cover plate with two screws, and a small diagram showing how to put the ratchet in like-new condition.

(Circle No. 9 on Reader Service Card)

DANGER
GAS
THE SAFE AND SANE WAY TO CLEAN
Automotive and Industrial Parts
Ideal for the critical cleaning of Automatic Transmissions and Power Steering units.
Kleer-Flo Model 30 (less Jet Air Gun) also available
Kleerflo
SUPER MODEL 50
CLEANMASTER
CLEAN PARTS 3 WAYS—SAFELY!
1. Continuous Flow Hose
2. Air Agitated Soaking Tank
3. "Super Power" Jet Air Gun
For carburetors . . . ask for a Kleer-Flo CARB-U-TATOR Parts Cleaner using CARBUSOL Compound.
Rugged equipment that users enthusiastically say "pays for itself many times over in efficient time-saving, long trouble-free usage!" A continuous flow pump strains, filters and ejects abrasive foreign material and returns clean Kleer-Flo Hi-T Degreasol or M-467 Cleaning Fluids through the semi-rigid hose to the upper soaking tank. Fire hazard is reduced through the use of these high flash point solvents and by a quick action fusible link in self-closing cover.
Efficient patented electric pump is driven by a fan-cooled brushless, sparkless motor.
CALL, WIRE, WRITE TODAY FOR INFORMATION
Hi-T M467
Hi-T DEGREASOL
SAFE! Leaves film that prevents rust
SAFE! Fast drying—leaves no film
America's Foremost Producers of Parts Cleaning Equipment
PRACTICAL MFG. CO.
DEPT. D-3
2840 4th Ave. S.
Minneapolis 8, Minnesota

Padded Tow Sling

According to Cam Tool Co., Inc., damage to bumpers, grill-guards, etc. when towing vehicles can be prevented by use of their new Cushion-Tow Sling, which incorporates high-strength cushioning pads at point of

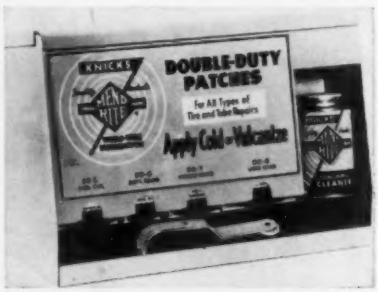
contact. The pads are adjustable along four hose-covered wire ropes and can accommodate all late model foreign and domestic cars.

Telescopic tow bars allow for fast, easy "hook-up"; mounting bracket includes universal swivel joint for greater towing stability. Sling may be drawn up tightly against rear of truck or carried in extended position when not in use. Adaptable to single or double boom trucks.

(Circle No. 10 on Reader Service Card)

Tire-Repair Dispenser

Knick Mend-Rite Co. has introduced a sturdy cabinet to keep all tire and tube repair materials in one central spot and save time and effort on jobs. Of heavy gauge metal, the cabinet



will dispense four sizes of the manufacturer's cold vulcanizing patches, and store other materials.

Finished in orange and black, the unit is designed for wall or counter installation; is offered stocked in an introductory deal, with five sizes of patches; one can of cement and one of liquid buffer, and one metal buffer and stitcher.

(Circle No. 11 on Reador Service Card)

Do You Trade, Buy, Sell or Finance USED CARS?

You Can Be an Authority Every Time With

RED BOOK

Official Used Car Valuations

New Edition Every 6 Weeks

Yearly Service $8.00

RED BOOK has grown with the automobile industry and belongs to it — that's why thousands of people always turn to it for current, realistic, authentic valuations and for quick identification. EVERY MODEL of EVERY CAR produced by an American manufacturing plant in the last 9 years is listed in RED BOOK with data covering standard and optional equipment. More than 25 import cars are listed in a separate section.

As the RED BOOK has been used throughout the country since 1911, it has been made to fit more and more exactly the need it was designed to fill—until today it has become a precise, unfailing tool.

RED BOOK gives you correct answers EVERY day when buying, selling, trading, or financing used cars. Complete—easy to use—has essential features found nowhere else. Everything you want is here—

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- **Visual identification by years and model series. Serial and motor numbers by years.**
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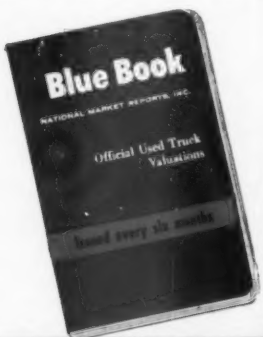

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ADDRESS_____

CITY_____

INDICATE: ☐ NEW CAR OR ☐ TRUCK DEALER_____ (MAKE)

OR OTHER LINE OF BUSINESS_____

RB-D

These are new *manufacturers' products*

Wagner Improves Packaging

The Automotive Division of Wagner Electric Corp. announces new packaging features for its hydraulic brake wheel and master cylinder repair kits.

Designed to facilitate handling, stocking, and filling orders, the new "break-apart ten pack" carton containing ten kits of the same part number is easily separated into segments of two, four, six or eight kits.

Carton holds kits firmly, with a patented gripper, preventing fall-out of kits even after being separated into segments. Kits are packed so that part number is plainly displayed at the open end of the carton for easy identification.

(Circle No. 12 on Reader Service Card)

Whirly-Bird Parts Washer

An electrically operated "Whirly-Bird" small parts washer, designed to fit a standard five gallon cleaning solvent can, has been announced by Graymills Corp.

According to the manufacturer,

there is no aeration of solvent and it is smooth and quiet in operation. The motor driven propeller below the screened basket bottom whirls the solvent around, over and through all parts, greatly accelerating cleaning time.

(Circle No. 13 on Reader Service Card)

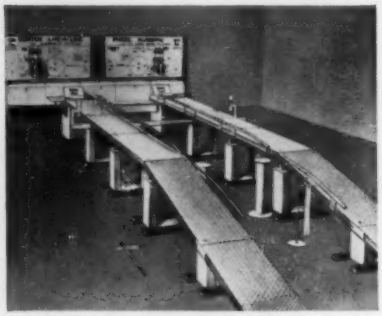
Adjustable Alignment Rack

Newest rack-type model in the Lite-A-Line wheel-aligner line offered by Hunter Engineering Co. is the deluxe 904-C1 adjustable-width group that includes 5-door cabinet, bedding beam and removable runways.

The 24"-high racks, mounted on sliding steel guide-rails, are easily adjusted sideways to accommodate vehicle tread widths from 40" to 68". Either or both sides of the rack are movable for operator-convenience.

The "folding-ramps" feature allows the hinged, treaded ramps to be retracted out of the way after the car is on the rack, or when the rack is not in use, allowing the working ease of a 24" rack in a space normally required for the smaller 16"-type rack.

Heavy-duty, ball-bearing turnplates are mounted on the sturdy, adjustable turnplate-pedestals, each of which has 2 sets of wheel-stops for the safety of the elevated vehicle being serviced. Two convenient hinged, treaded step-



plates are featured for ease in making under-the-hood alignment adjustments. Each runway and ramp section has steel tubular guard rails, two 22½" jack stands and a bending-beam for using air jacks.

All models include the new, improved Lite-A-Line projectors which give magnified, super-accurate alignment readings on the front charts, eliminating the need for side charts. A complete front-end check for caster, camber, turning-angle, king-pin inclination, wheel-track, toe-in and center-steering can be made in five minutes. Only two turns of the front wheels are needed for all readings, and repeated crawling out from under the vehicle to read gauges is eliminated.

(Circle No. 14 on Reader Service Card)

"I want you to get on this other job right away!"

Trunk Drain Kit Cures Chevy Floods

C. N. Butts

A new "rescue kit" designed by Houser Engineering and Mfg., Inc., creates a profitable new service job that every owner of a 1959 Chevrolet needs. In this new Chevy model (as many dealers have sorrowfully learned) when rain rolls down the forward angle of the trunk gutter, where does it roll? Right down into the trunk!

Immediate Permanent Cure Builds Goodwill at Low Cost

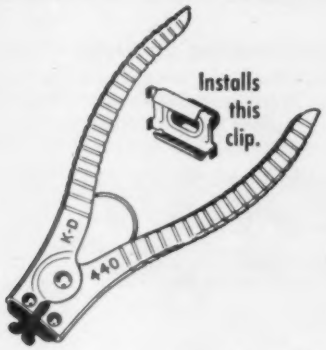
By installing the low-cost Houser Trunk Drain Kit as part of pre-delivery servicing, dealers are also **avoiding** trouble and complaints, successfully building and keeping goodwill.

Easy Half-Hour Installation

Easily installed at each forward corner of the trunk gutter, a drain fitting holds a rubber tube which carries the water out thru the forward wall or floor of the trunk section. Each Houser Trunk Drain Kit provides 2 each of special brass drain fittings, rubber washers, steel washers, and nuts, plus ample tubing to drain both corners. Clear easy instructions are included. The kit lists at only $3.95 and offers a profitable service extra. Like all other Houser products, this kit is sold on a money-back guarantee. For additional information write to **Houser Engineering & Mfg., Inc., Bluffton, Indiana.**

Molding Clip Tool

A new molding clip installing tool especially designed for installing molding clips in late Chevrolet and



Pontiac cars is announced by the K-D Manufacturing Co.

Jaws of the tool fit inside clip; squeezing handles expands clip, holding it in place.

(Circle No. 15 on Reader Service Card)

Portable Epoxy Resin Drier

Averting the danger of hot-spotting and costly overheating, common hazards in drying epoxy resin materials,

is one of the advantages claimed for a unique portable infrared drier designed by The Fostoria Pressed Steel Corp. expressly for such work in body shops. The portable unit is also used for drying putty, touch-up painting and numerous other service shop jobs.

No warm-up period is required. Instantaneous, uniformly even heat is provided by highly specular reflectors. Metal is preheated and plastic is said to be safely cured with exceptional speed; reductions up to 80% in drying time over other methods commonly used have been reported by body shops.

Clear 250-watt, G-30 type infrared lamps are supplied with the lightweight, self-contained drying unit. It can be moved around the shop, adjusts to heights up to 5 feet and also swivels 180° for varying angles of drying.

(Circle No. 16 on Reader Service Card)

Carburetor Repair Kits

United Motors Service division of General Motors recently announced plans to market a line of economy-priced carburetor repair kits—a new service-parts development of GM's

Rochester Products division.

The kits contain all of the carburetor parts which extensive road tests revealed to be most susceptible to wear under normal operating condition, with a resulting loss of engine performance and fuel economy. To date it is the only such service-parts package to offer a four-ounce can of cleaner for adding eye appeal to each completed job.

Available for most Rochester carburetor-equipped cars, the kits contain complete instructions which enable any general mechanic to perform the carburetor repair jobs.

(Circle No. 17 on Reader Service Card)

KING PORTABLE TESTER WITH LARGE Professional-Size METERS

$194.15 COMPLETE

you save $24.50 over units purchased separately

The Model 429 Portable Tune-Up Set gives you big garage equipment with minimum investment . . . only $10.95 a month on Commercial Credit payment plan. It's self-supporting from the day of delivery!

Rugged metal case with convenient lead compartments, holds testers firmly locked in place, yet readily removable for individual use.

SET INCLUDES:

VOLT-AMPERE TEST . . . . . for Generator-Regulator-Battery.
*COIL TEST . . . . . for on or off the car testing.
*CONDENSER TEST . . . . . for on or off the car testing.
IGNITION-OUTPUT TEST . . . . . for balanced ignition.
*0-100,000 OHMMETER . for testing radio-type ignition wires, suppressors, etc.
CAM ANGLE TEST . . . . . for checking point-spacing and performance.
TACHOMETER . . . . . for checking engine speeds 0-1000 & 0-5000 RPM.
6/12 VOLT POWERLITE . . . . for brilliant focused beam for ignition timing.
*VACUUM GAUGE . for checking carburetion and overall engine performance.
*PRESSURE GAUGE . . . . . for testing fuel pump operation.

*EXCLUSIVE FEATURES! Available only with KING.

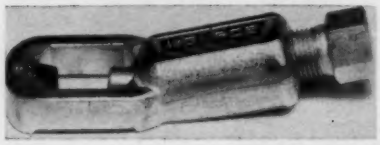
Simple to use! Easy-to-follow instructions show you how to cash in on profitable motor tune-up and how to keep your profits by eliminating "come-backs". Why delay? See your jobber or write KING for full information.

KING ELECTRIC EQUIPMENT CO.
9123 INMAN AVE. CLEVELAND 5, OHIO

These are new *manufacturers' products*

Nut-Cutting Tool

This Monroe nut-cutting tool, designed specifically to speed up shock absorber work, is also effective on a wide range of nut sizes up to ¾" across flats. The working end of the tool is offset at a special angle so that it can be used in minimum clearance applications to make quick work of splitting those rusted or damaged nuts encountered on tailpipes, muffers, etc., as well as on body bolts. Cutting chisels and all moving parts of the tool are fully replaceable.



(Circle No. 18 on Reader Service Card)

BRAKE PARTS
POWER BRAKE KIT MINOR 6978316
POWER BRAKE KIT MAJOR 5978282
BRAKE PARTS
Now ready...
POWER BRAKE KITS, PARTS CATALOG*
EIS
CATALOG 27P
THE BRAKE PARTS LINE
POWER BRAKE PARTS & KITS
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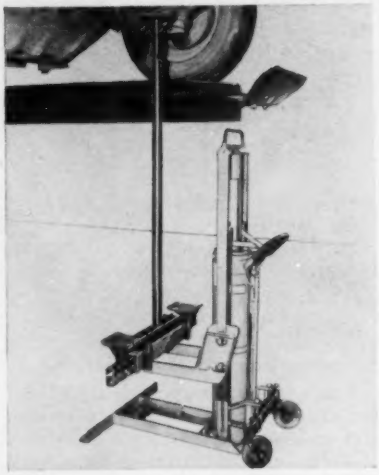
If you haven't received your copy, better ask your EIS Distributor or write for it at once! Ask for Catalog No. 27P.
EIS AUTOMOTIVE CORP., MIDDLETOWN, CONN.

Jack Extension for Hoist Work

To relieve the weight of a car when it is raised on a hoist, so as to facilitate muffler and tailpipe work, ball joint greasing, or spring and shock absorber replacement, the Branick Mfg. Co., Inc. has introduced this adjustable jack extension for use with their bumper jacks equipped with telescoping arms.



(Circle No. 19 on Reader Service Card)

Muffler Display Rack

This latest Maremont muffler display rack displays one or two mufflers with a special sales message on the muffler calling attention to the Maremont "Acid Test for Mufflers" telecast, live on the Jack Paar and "Today" shows. Designed especially for counter use, the rack incorporates a four-color, eye-catching sign.

(Circle No. 20 on Reader Service Card)

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at no cost or obligation

● Use the convenient, postpaid Reader Service Card at the right to obtain additional information about products, services or developments reported or advertised in this issue of AUTOMOTIVE SERVICE DIGEST.

Simply circle the key number corresponding to the one that appears with the editorial review, or with the name of the advertiser in the list below.

Our Reader Service Department forwards your inquiry to the manufacturer or supplier, who will mail the information directly to you.

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March, 1959—Void after June 30, 1959

Please send me more information about the items identified by the key numbers circled below:

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Name .....

Title ..... Firm .....

Address .....

City ..... Zone ..... State .....

TYPE OF BUSINESS: ☐ Car or truck dealer ☐ Fleet operator ☐ Auto repair & service
☐ Automotive jobber ☐ Filling station ☐ Service station ☐ Other.....

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CITY..... ZONE..... STATE.....

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☐ Auto Repair and Service ☐ Service Station
☐ Automotive Jobber
☐ Other Than Above .....
(Above rates good only in United States and Canada)

3-59

TECHNICAL HELP FOR THE SERVICE SHOP

AUTOMOTIVE SERVICE DIGEST is specifically edited for the service specialists of the automotive industry . . . the men who keep automobiles on the road, performing at their best. From front cover through the "Smiles" page, all articles and departments are devoted to subjects and services that will help the man in the shop to do a better job, more profitably.

"TECH KNOW-HOW" FEATURES

●ONLY ASD provides the automotive service field with timely, authoritative, detailed articles of this type. Prepared by men who have the actual experience, as well as the education to "live with" the increasingly specialized service needs of the modern automobile, these features go deeply into the methods and mechanical parts involved. Most "Tech Know-How" write-ups are step-by-step "how-to" descriptions of the latest procedures in a key servicing operation.

"BUSINESS KNOW-HOW" FEATURES

● Covering the "dollar sign" side of our readers' information needs, ASD "Business Know-How" articles present management subjects from the specific automotive service shop viewpoint. They are written for owners and supervisory personnel, by authors of recognized business-management ability; and are based on the actual day-to-day problems of a going automotive service establishment.

AUTOMOTIVE SERVICE EDUCATION

● Toward the solution of one of the most acute needs of our industry, AUTOMOTIVE SERVICE DIGEST carries a continuing series of reviews on how and where the skilled technicians of tomorrow are being trained. Going deeply "into cases," the Service Education series answers the questions of prospective student and management alike.

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Chicago, Illinois

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Chicago 5, Illinois

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FIRST CLASS
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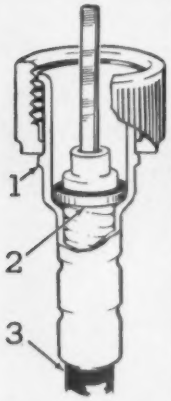
Chicago, Illinois

POSTAGE WILL BE PAID BY—

AUTOMOTIVE SERVICE DIGEST
900 South Wabash Avenue
Chicago 5, Illinois

Speedometer Replacement Parts

Hall Products Division of C. M. Hall Lamp Co. announces a new line of Duro-flex universal speedometer core kits and cable-and-casing assemblies built to car-factory specifications.



The 21-strand replacement core comes in two lengths, enabling the mechanic to tailor-fit any car or truck speedometer with one or the other. Each kit contains a properly-measured amount of lubricant especially compounded for speedometer cables that guards against fouling the assembly or speedometer-head mechanism through improper or excessive grease. Core has one square end, and kits also include a square tip for tailored end, a crimping tool and installation instructions.

Duro-flex cable-and-casing assemblies offer three exclusive features, as shown herewith. (1) Self-secured attachment nuts that can't slip down the cable and out of reach during installation; (2) a special fiber washer insert seated in the speedometer end ferrule to assure continued noiseless operation, and (3) vinyl anti-rattle covering on all casings. Casings are rust-and-leak proof and assemblies are factory lubricated.

(Circle No. 21 on Reader Service Card)

C-Clamps Have "Perma-Pad"

A new line of forged steel C-clamps, available in seven sizes, 2" through

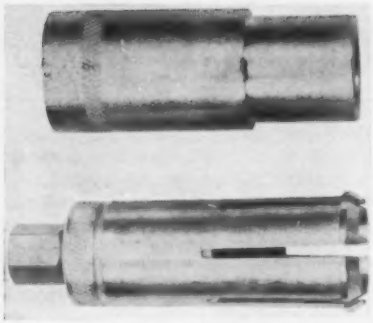
12" capacities is announced by Proto Tool Co.

In addition to extra-deep throats, heavier, sturdier spindles, the new clamp features a swivel pad that is guaranteed never to come off.

(Circle No. 22 on Reader Service Card)

Propeller Shaft Bushing Kit

New propeller shaft bushing kits by O.E.M. Products, are said to offer positive time saving on Chevrolet passenger car and truck installations. Precision made, they permit complete



change of propeller shaft bushings in less than an hour, with two numbers fitting almost all jobs. A new O.E.M. tool, the Propeller Shaft Bushing Driver (No. 2010) is used with these kits to assemble them into the drive shaft housing.

Two other tools are also precision made of top quality spring steel, cadmium plated. The Rear Transmission Bushing Extractor (No. 2030) has no parts to wear out, and is designed to permit quick, easy removal of rear transmission bushings on Ford and Chevrolet without removing extension housing. No. 2040, the new Rear Transmission Bushing Driver for use with the Extractor, replaces Chevrolet and Ford Rear Transmission bushings.

(Circle No. 23 on Reader Service Card)

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These are new *manufacturers' products*

Dual Action Air Sander

A new dual action, air operated sander is announced by National-Detroit, Inc. for use in finish sanding prime coats, surfacer and old finishes to remove road film, oxidized paint or gloss, prior to refinishing.

The dual action of the sander is said to make possible considerable cost savings in sanding time, abrasives and paints. Dual action best describes the action, as the sanding pad actually moves in two different directions at one time. This compound motion, according to the manufacturer, prevents the creation of heat, and at the same time provides a mechanical cleansing action for the abrasive.

Another important operation for which dual action is said to be superior is in two-toning acrylic finishes: Two-toning requires thorough sanding and complete removal of gloss to provide the necessary tooth for a perfect bond.

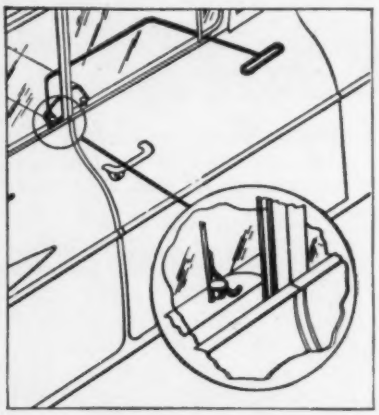
The sander requires only 55 lbs.

of air pressure, it can be used on either curved or flat work and it sands flush to right angle surfaces.

(Circle No. 24 on Reader Service Card)

Auto Skeleton Key

Sooner or later almost everyone locks his keys in his car—or it may be that a locked car must be moved in an emergency when the whereabouts of the owner is not known. In such cases, it will pay you to have this



"key" handy in your shop—or as a part of your service truck's equipment.

Manufactured by the Steck Mfg. Co., the tool is of 1-piece construction and thin enough to easily fit in under vent wings. Its shape is such that easy manipulation permits the curved end, or finger, to lift the push-button lock on doors so equipped, or the hooked end can be used to engage the inside door handle to release the lock. According to the manufacturer, 95% of all door locks can be opened with the "key."

(Circle No. 25 on Reader Service Card)

BAR'S RUST STOPS CORROSION

in the auto cooling system

Now comes the season for everyone to inhibit rust and scale in automotive cooling systems. Simply pour pelletized BAR'S RUST into radiator . . pelletized chemical inhibitors slowly dissolve in the water . . . effectively protect cooling system against corrosive damage.

BAR'S RUST brings you extras . . functions as the one inhibitor that stops leaks in head gaskets, porous engine metal, cracked blocks and rust holes . . . serves as emulsifying water pump lubricant . . . proved through use in millions of cars to be the world's No. 1 cooling system protective.

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Available through automotive jobbers, service stations and automotive goods stores.

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Read the best seller—Nautilus 90 North—Chapter 13, pages 134-135

BAR'S PRODUCTS SUPPLY, INC.

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Combination Charger-Tester

A new combination fast charger-tester is announced by Christie Electric Corp. who claim that the new cell balance test system in their machine provides the best and simplest "on the spot" test yet developed. Both "open circuit" and "load" tests are applied to the battery. The manufacturer further states that the self-adjusting charging system automatically adjusts to the rate of charge the battery can safely absorb.

The silicon rectifier is fully guaranteed for five years; all other components for two years.

(Circle No. 26 on Reader Service Card)

MoPar Cool Aire Units

The MoPar Division of Chrysler Motors Corp. announces a new line of MoPar Cool Aire units designed exclusively for 1957, '58 and '59 Plymouth, Dodge, DeSoto and Chrysler cars. This is said to result in easier installation with no major alterations needed under the hood or in the front passenger compartment. The Cool Aire's cooling coil fits snuggled under the instrument panel, out of the way and protected from engine heat. Other components are easily installed in space available under the hood.

Air temperature is thermostatically controlled. Three large adjustable grilles can be rotated 360°, allowing the clean, cool, dehumidified air to be directed in any direction—or several directions at once.

In off seasons, when no cooling is desired, a clutch automatically disengages the system's compressor, reducing engine load and increasing the life of the entire Cool Aire system.

(Circle No. 27 on Reader Service Card)

Brake Shoe Return Springs

A small handy assortment of the 10 fastest-moving sets of brake shoe return springs has been announced by Lee Mfg. Co. The assortment, known as the "Ten-Pack," consists of 10 packaged sets, 4 springs to a box (axle sets), including extra heavy-duty springs for power brakes. The "Ten-Pack," is designed especially for garages and service stations doing relines, requires minimum investment for maximum service coverage, according to the manufacturer. The "Ten-Pack" comes in an attractive counter display.

(Circle No. 28 on Reader Service Card)

Paul Marsh COMPANY

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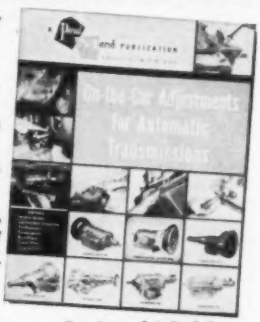

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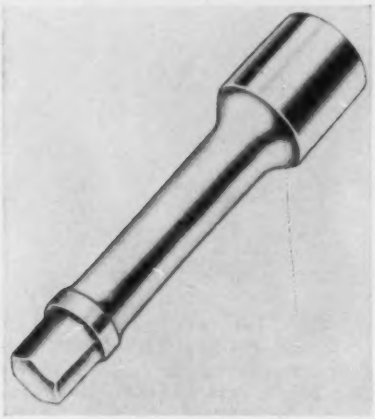
These are new *manufacturers' products*

Ford Differential Plug Wrench

To fill an "urgent need," Herbrand announces a one-piece wrench de-



veloped specifically to save mechanics time, effort and knuckles when removing and replacing the hex filler plug on the differential of the 1959 Fords and Mercurys.

Used with a standard ratchet or hinge handle, it clears the extra long stud in the housing which makes this plug a tough one to get at. 3⅛" long and with ⅜" hex and drive ends, the tool (J-42) is made of alloy steel and chrome plated.

(Circle No. 29 on Reader Service Card)

Induction-Type Ammeter

A new, portable, induction-type DC ammeter that measures approximate generator current up to 75 amps, is announced by the Burton-Rogers Co. To use, the meter is simply held closely over a convenient straight section of cable to read current directly without hooking-up or breaking into the circuit. On late model cars without a dash ammeter (only warning lights), the company states that this meter is especially useful for making a quick check on generator charging rate.

Finished in red and chrome, the meter features a wide scale with large black numerals and a red pointer to make it easy to read, even in under-the-hood areas.

(Circle No. 30 on Reader Service Card)

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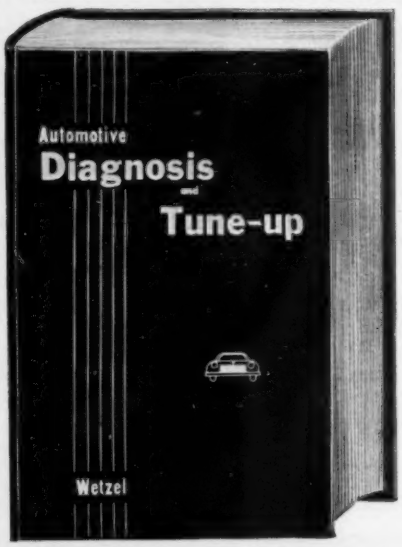

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MERCHANDISING IDEAS . . . A new 20-page Idea Book now being offered by the Bear Mfg. Co. contains full-color illustrations of many modern Bear services showing how equipment can be located for greater efficiency and eye appeal. Colorful illustrations show how business can be increased by proper selection and placement of equipment. Many new services are shown, including the Bear Economy outfit for small shops, the body-frame straightener, etc. Also contained in the book are ideas for exterior displays, showing how the proper use of signs can make shop fronts more attractive to new business.
(Circle No. 31 on Reader Service Card)

HYDRAULIC BRAKE SYSTEM . . . four-color wall chart shows all parts of the automotive hydraulic brake system to enable shopmen to educate customers on the importance of brake service and necessity for high quality brake fluids. The chart shows different types of foundation brakes and also cut-aways of master and wheel brake cylinders. An especially valuable feature is a comprehensive list of operational faults with a number coded correction indicated to overcome each.
(Circle No. 32 on Reader Service Card)

COLD WEATHER STARTING . . . Catalog sheet from Philips Manufacturing Company describes complete line of "Zero Start" external tank type electrical engine heaters. Discusses units for cars, trucks, tractors or stationary power installations; gives heater model specs and prices; illustrates application set-ups. Copies free on request.
(Circle No. 33 on Reader Service Card)

AXLE SHAFT FAILURE . . . U.S. Axle Co.'s pictorial wall chart (14"x17") highlights the common faults responsible for most axle shaft breakdowns, both mechanical and human. Cartoon-

Calendar of Automotive Events

1959

March 12-15—Pacific Automotive Show, New Brooks Hall, San Francisco Civic Auditorium, San Francisco, Calif.

May 3-8—Top Management Institute, Motor and Equipment Wholesalers Assn., Allerton House, University of Illinois, Monticello, Ill.

May 17-20—Automotive Engine Rebuilders 37th Annual Convention, Royal York Hotel, Toronto, Ontario, Can.

June 24-27—Independent Garage Owners of America, Inc. (IGOA) National Convention, Albany Hotel, Denver, Colo.

Oct. 28-30—Automotive Parts Rebuilders Assn., 12th Annual Convention, Hotel Roosevelt, New Orleans, La.

Nov. 2-5—Automotive Warehouse Distributors Assn., Annual Convention and Manufacturers'-Distributors' Conference, Muehlebach Hotel, Kansas City, Mo.

'59 Chevrolet Tail Lamp Circuit Requires 15 Ampere Fuse

Electrical junction blocks used in early production 1959 Chevrolet passenger cars were stamped to show requirement of a 10 ampere fuse in the tail lamp fuse holder located in the upper right corner of the block. Instructions indicating use of a 10 ampere fuse in this circuit were in error, as circuit load requires use of a 15 ampere fuse.

This condition has been corrected on junction blocks of later manufacture. If a 10 ampere fuse is found in this circuit, replace with a 15 ampere fuse and obliterate the "10A" marking at that location on the block.

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type art "on the human side" illustrates careless use of clutch; sudden, jerky or rough starts; rocking when stuck; overloading and unbalanced loads. Faults illustrated on the mechanical side are: loose bolts, loose wheel bearings, faulty clutch condition, out-of-line housing, and faulty alignment. Yours free on request.

(Circle No. 34 on Reader Service Card)

BRUSHES OF ALL TYPES . . . Flour City Brush Co.'s 1959 catalog (#211) consists of 120 pages listing their complete line of over 1,000 articles . . . all illustrated with a thorough description of each item. The company offers the most complete line of replacement rotary machine brushes, as well as a large variety of brushes for use around the automotive shop.

(Circle No. 35 on Reader Service Card)

MASTER BRAKE SERVICE GUIDE . . . now available from World Bestos, gives fully illustrated, step-by-step instructions for adjusting and relining twenty types of hydraulic wheel brakes. Service procedures, based on manufacturers' shop manuals, contain the latest information available.

Useful features include the Hydraulic Brake Finder which identifies wheel brakes on automobiles, trucks and buses back to 1936; three full pages of trouble-shooting pointers and a brake inspection check list. Also contained in the Guide is general service information telling how to flush and bleed the hydraulic system, as well as basic instructions for overhauling master cylinders and wheel cylinders. Instructions for adjusting six types of drive shaft brakes are also included.

(Circle No. 36 on Reader Service Card)

SMALL ENGINE IGNITION PARTS . . . 12-page, 2-color catalog lists Echlin's new line of ignition parts for small engine flywheel magnetos. Included in the new line are Echlin contact sets and condensers for flywheel magnetos used on all popular power mowers, outboard motors, chain saws, garden tractors, motor scooters and stationary engines.

(Circle No. 37 on Reader Service Card)

MUFFLER PROMOTION KIT . . . being offered by Pratt Muffler Div., MarPro, Inc., contains a dozen merchandising aids, including 1959 advertising preprints, a transparent acetate window sticker, envelope stuffers, a set of four danglers, paper pennant sets, a decal type sticker, ad mat proof sheet, six muffler mailing cards, a Pratt poster and a self-mailer to order the indoor fluorescent sign.

(Circle No. 38 on Reader Service Card)

TUNE-UP SPECS . . . A new 16-page, flip sheet wall chart of tune-up specifications and original equipment tune-up parts listings for all makes and models of passenger cars for the years 1950 through 1959, is being offered by the Automotive Electric Association, Detroit, Mich.

Tune-up parts listed in the detailed breakdown per passenger car—make and model—include: spark plugs, distributors, contact sets, caps, rotors, condensers, coils, generators, regulators, fuel pumps and carburetors. Tune-up specs lists manufacturers' information on batteries (voltage and ground); spark plug gap; distributor rotation, point gap and cam angle; ignition timing; timing mark location; firing order; idle speed (standard and automatic transmission); fuel pump pressure, and regulator operating voltage range. Back cover of the chart features a graphic table for firing orders, cylinder numbering arrangements and ignition timing mark locations.

(Circle No. 39 on Reader Service Card)

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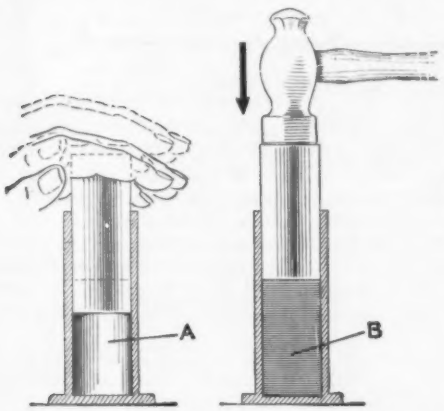
Refresher course

✔ *Air and liquids under pressure*

• GASES OR AIR under pressure act in the same way as liquids under pressure, undiminished in all directions, and on all parts of the enclosing wall.

Pascal's Law or principle applies to gases as it does to fluids. The hydraulic brake system is based on Pascal's principle. It states that pressure exerted anywhere in a confined liquid is transmitted undiminished to every portion of the interior of the containing vessel.



Air "A" in tube is readily compressed by pressure on the plunger. Fluid "B" is practically incompressible, even by hammering on the plunger.

Of interest is the striking difference between compressed air and a liquid under pressure. The volume of air is substantially reduced by pressure while the volume of a liquid under pressure remains virtually constant.

For example, in a tube equipped with a closely fitted plunger, air can be compressed by pushing down the plunger by hand. When the plunger is released, it springs back nearly to the initial position, showing that air is highly compressible. If the tube contains a liquid, the plunger cannot be pushed inward. Even if the plunger is struck with a hammer, the effect is as if the tube were a solid column. This clearly demonstrates the compressibility of air and incompressibility of a liquid.

Change in Shift Linkage Cuts Lost Motion and Wear

The Dodge Service Department reports a production change in its Model W-100 and W-200 trucks to reduce lost motion and wear between the steering gear gearshift tube and steering gear gearshift hand lever. This was done by replacing the press fitted steering gear gearshift lever pin with a threaded pin.

Mechanics can make this change in the field by:

A. Drill out one side of the steering gear gearshift tube arm to a ¼" diameter.

B. Drill out the steering gear gearshift hand lever pin hole to a ¼" diameter.

C. Replace the steering gear gearshift hand lever anti-rattle spring with new anti-rattle spring (Part No. 185-6987).

D. Replace steering gear gearshift lever pin with new pin (Part No. 185-6988).

E. Place the steering gear gearshift lever pin nut (Part No. 271168) on the lever pin and tighten.

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How To Buy A Battery Charger

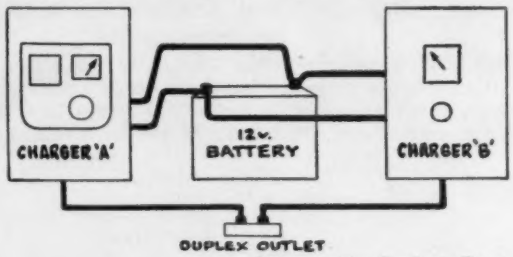
• ACCORDING TO ONE of the latest AAA reports, you're probably going to be face-to-face with a lot of "down" batteries this year. Recently released figures indicate that battery failure continues to be the No. 1 cause for road breakdown.

To meet this situation, a shop needs to be equipped to charge dead batteries easily and efficiently. While it's easy to buy a charger, there's a trick to getting the one that's best suited to your shop business.

Today, many battery chargers are combined with battery testers for checking as well as servicing batteries. Whether or not you want to offer this kind of service is up to you. If you do, it's well to keep in mind the following points.

Recent developments in battery construction practically require an "overall" tester with connections only to the battery posts. Not only is it a slower process to prod each cell; but with cell connectors covered, this prodding is difficult. In some of the newest batteries, it is impossible.

Most inexpensive battery testers in use today are the "cell-voltage-under-load" type. As these give significant readings only on warm batteries that have considerable charge in them, they should not be used on cold or flat batteries. Before-charge testing requires an open circuit tester, which gives significant readings only after the



Courtesy Fox Products Company

"surface charge" has been removed. This can be accomplished by turning car lights on for 2 minutes. Some of the new testers will remove the surface charge in 10 seconds under load before making an open circuit test.

Overall open-circuit readings of less than 6.15 volts or 12.30 volts indicate that the battery either needs a charge or is defective. After charging and under a load equivalent to the starter, readings should be at least 5.40 or 10.80 volts. Otherwise the battery is defective and should be replaced.

Reduction of road failures requires generator-regulator testing as well as battery testing. A tester having a generator-regulator scale, for use with the engine at a fast idle, makes it possible to assure that the battery will be properly charged in the car.

It has been found that 12-volt batteries tend to have a lower charge acceptance than 6-volt batteries. This requires higher performance from 12-volt than from 6-volt chargers. In fact, many chargers that work satisfactorily in mild weather, do a very poor job on 12-volt batteries in cold weather, when most charging is done.

A comparison of charging ability by different makes of chargers reveals that some brands, in actual practice, fall far short of their ratings.

MAKE	12-VOLT RATING	CURRENT INTO 32°F FLAT 12v. BATTERY	RELATIVE PERFORMANCE
BRAND A	40 amps	39 amps	97 percent
BRAND B	50 amps	13 amps	26 percent
BRAND C	45 amps	31 amps	69 percent
BRAND D	80 amps	15 amps	19 percent
BRAND E	50 amps	15 amps	30 percent

How can a shopman, who can't make these laboratory tests, tell what he is getting? One fairly simple method is by a trial charge into a warm (above 50°F), charged 12-volt battery. Such a battery behaves essentially like a cold, flat one usually requiring a charge during the winter.

Another way is to hook up two different-make chargers on the same battery at the same time, as illustrated. Plugged into the same line, the line voltage is the same for both chargers. In this way you can compare ampere output and performance. If, as is the case with Charger "B" in the diagram, there is no ammeter, you can connect one into the output circuit between the battery post and the clamp.

Here are some points to consider:

1. **Investigate "Automatic" claims.** There are automatic features in all chargers; but a charger is not truly automatic and safe if it depends on the operator to do anything more than clamping it to the battery. If required charging time has been figured and set by the operator, it's not automatic. If the charger doesn't cut off if the leads are reversed, it's not automatic. And if it will charge when the thermostat is left out of the battery, it's not automatic.

2. **Look for an ammeter.** An easily read ammeter tells you the amount of charge going into a battery. If a charger has a voltmeter or an uncalibrated ammeter, you can't know how much current is going into the battery.

3. **Be sure about circuit breakers.** These provide protection for the charger and the battery against errors in battery hook-up or switch-setting.

4. **Selenium vs Silicon rectifiers.** Buyers have been attracted to silicon chargers because they offer a 5-year guarantee. Faced with this competition, manufacturers of selenium rectifiers, using a German patent, have come out with a new selenium rectifier that acts on the same principle as the silicon type. The aging characteristics have been eliminated in these new selenium rectifiers and, as a result, they are also covered by a 5-year guarantee.

5. **Open-wound, well ventilated transformers.** The heat generated in transforming heavy currents must be dissipated to avoid damage to the charger.

6. **Life-time lubricated fan bearings.** The fan, one of the few moving parts in a charger, is running all the time the charger is on. Unless sealed-in, lubricated bearings are used on the fan blade, trouble can develop.

7. **Safe fast-charger control.** This is automatic protection against over-charging or over-heating. The thermal type works without attention from the operator. Timer types are satisfactory when correctly set.

8. **Rugged construction is important.** Because of the normal beating a charger must take under average conditions, design and construction are vitally important to the efficiency and length of service obtained from the charger units. Heavy-gauge steel chassis and frames serve to protect the more delicate components of a charger and its controls. Mobile units should have rugged wheel assemblies and large diameter wheels to permit their rolling through gravel and over curbs.

9. **Copper cables.** Make sure the cables are the heavy-duty type of stranded copper and of sufficient gauge to handle the rated output. They should be securely anchored, to prevent damage from pulling. The unit should have adequate cable-storage space inside the cabinet or on hooks outside. Check the clamps too.

10. **Read the small print in the guarantee.** Some do not include service after the sale.

In the final analysis, battery chargers are like most other items. The more you know about them, the better buy you will make.

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HE WHO LAUGHS, COME WHAT MAY,

WILL LIVE TO LAUGH ANOTHER DAY

Short circuit smiles

An eight-year-old lad was asked by his mother what he had learned at Sunday school. "Well," he said, "our teacher told us about when God sent Moses behind the enemy lines to rescue the Israelites from the Egyptians. When they came to the Red Sea, Moses called for the engineers to build a pontoon bridge. After they had all crossed, they looked back and saw the Egyptians' tanks coming. Moses radioed headquarters on his walkie-talkie to send bombers to blow up the bridge and saved the Israelites."

"Bobby!" exclaimed his mother. "Is that really the way your teacher told you that story?"

"Not exactly," Bobby admitted. "But if I told it her way, you'd never believe it."

★ ★ ★

A salesgirl was describing a new four-piece outfit a model was wearing: "If you remove the bodice you have a playsuit. If you remove the skirt, you have a sunsuit. If you remove anything else, you have a lawsuit."

★ ★ ★

To live happily in the country one must have the soul of a poet, the mind of a philosopher, the simple tastes of a hermit—and a good station wagon.

★ ★ ★

One bookie to another on leaving a church service:

"The word is 'Hallelujah,' stupid, not 'Hialeah'!"

★ ★ ★

The local weatherman was so often wrong in his predictions that he became the laughing stock of the community. He applied for a transfer to another station.

"Why," wrote headquarters, "do you wish to be transferred?"

"Because," the forecaster answered, "the climate here doesn't agree with me."

An Iowa farmer, on his first visit to the big city, stopped in a plush cocktail lounge and ordered a beer.

"How much beer do you sell a week?" he inquired.

"About 40 kegs," replied the bartender.

"I'll tell you how you can sell 80."

"Eighty kegs?" said the bartender, amazed. "How?"

"Simple," answered the farmer. "Fill up the glasses."

★ ★ ★

Joe took his new girl friend to the ball game. She watched the game with only mild interest. "Look," Joe exclaimed, "we've got a man on every base!"

"So what?" she asked languidly. "So has the other team!"

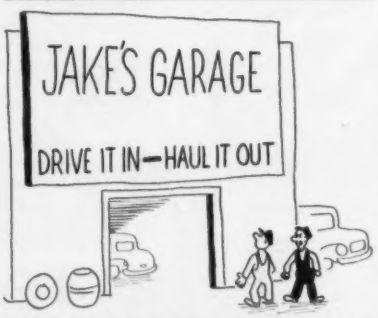
★ ★ ★

A teen-aged boy and his girl friend were out driving one fine summer evening. They came to a quiet spot on a lonely country road and the car suddenly stopped. "Out of gas," said the boy.

The girl nonchalantly opened her purse and pulled out a flask.

"Swell," exclaimed the boy. "Is it scotch or bourbon?"

"Gas," replied the girl.



"Hank . . . ! Call that sign painter back here . . . and make it quick!"

The couple was leaving church. "Did you see that new purple hat Mrs. Lambert was wearing?" the wife asked.

"I'm afraid not," the husband replied.

"What did you think of that orange velvet dress Mrs. Frawley had on?" the wife asked.

"I didn't notice it either," the husband said.

"Oh, for goodness sakes," snapped the wife, "a lot of good it does you to go to church!"

★ ★ ★

Annie—"What happened to that young man of yours with money to burn?"

Jennie—"He met his match."

★ ★ ★

"Dad, guess what? I've got my first part in a play," enthused the budding young actor. "I play the part of a man who's been married for 25 years."

"That's a good start, son," replied his dad. "Just keep at it and one of these days you'll get a speaking part."

★ ★ ★

Parents spend the first part of a child's life getting him to walk and talk, and the rest of his childhood getting him to sit down and shut up.

★ ★ ★

The salesman stared doubtfully at the formidable looking animal lying on the doorstep. "What breed is your dog?" he asked the lady of the house.

"Don't rightly know," she answered. "My brother sent it from Africa."

"Well," said the salesman, hesitantly, "it's the queerest dog I've ever seen."

The lady nodded. "You should have seen it before we cut its mane off."

★ ★ ★

One of the main frustrations of any elevator operator is that he never hears the endings of stories.

★ ★ ★

"I ache all over," a man complained.

"What's the trouble?" his friend asked.

"A couple of weeks ago we bought a lot of ultra modern furniture," he explained, "and I just found out that all this time I've been sleeping in the bookcase."

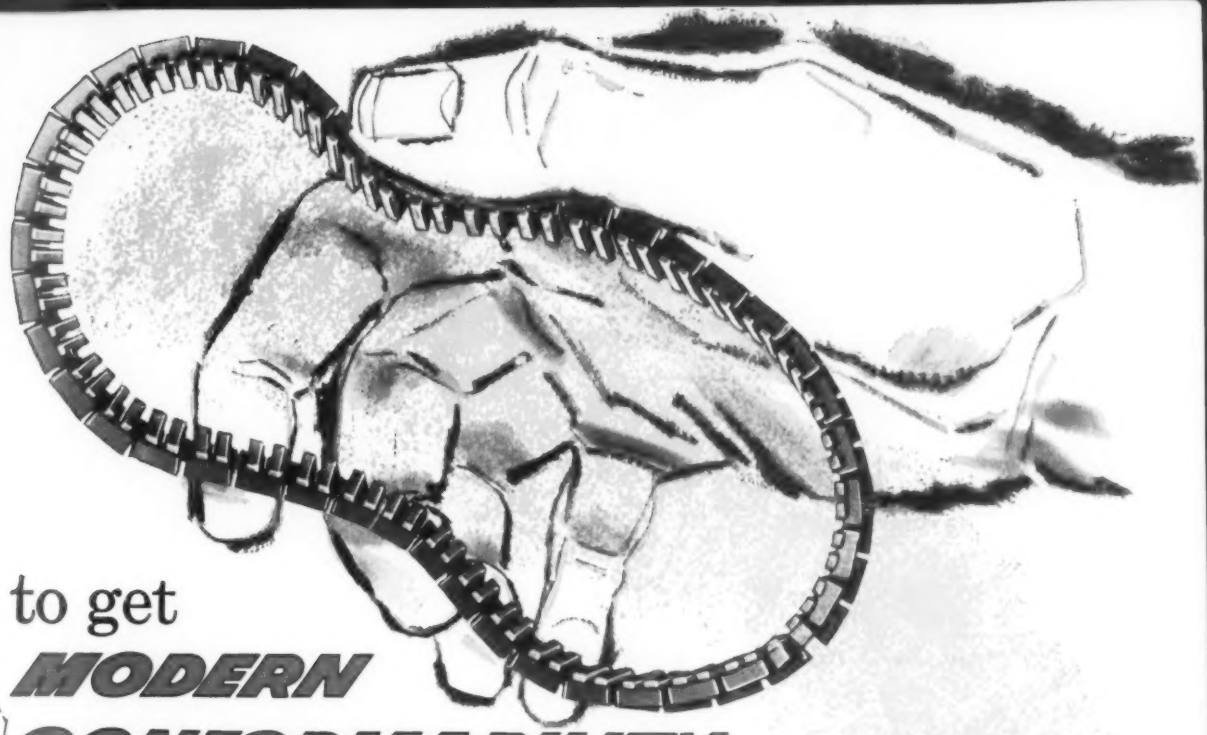
★ ★ ★

One friend said to another, "Say, how did you get that scar across the bridge of your nose?" "From glasses." "Well why don't you get contact lenses?" "They don't hold enough beer."

★ ★ ★

"Darling," cooed one girl to another. "What a beautiful mink coat. How did you get it? I've been struggling for years to save up for one."

"Honey," advised the hired friend. "Stop struggling. You won't need to save."



to get MODERN CONFORMABILITY every time... power up with Ramco 10-up sets

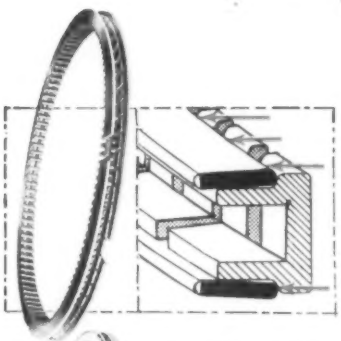
Look at the illustration above.
It shows the heartbeat of conformability.

When butted end to end, the Duomatic expander acts like a coiled spring, exerting outward pressure against wafer-thin rails.

No matter how worn, tapered or out-of-round a cylinder may be, the expander automatically adjusts, *conforms*. Like the human heart, it's constantly at work: expanding, contracting, expanding...

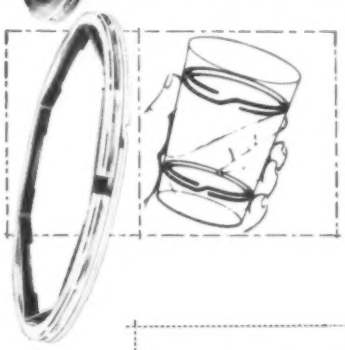
Both C-9 and Spiro-Seal oil rings have this MODERN POWER action. That's why C-9 (in newer engines) and Spiro-Seal (in older engines) means satisfied customers for you.

To find out more about them, call your RAMCO Jobber.



C-9 Conformability

Instant response to taper and wear is essential to MODERN POWER. C-9 brings this response to a modern new high with extreme flexibility of Duomatic expander and radially thinner rails.



Spiro-Seal Conformability

Spiro-Seal segment works like a watch spring: expands, contracts, depending upon cylinder taper or wear. Rides free of inner ring pressure until after seat-in.

RAMCO MODERN POWER PISTON RING SETS

Ramsey Corporation, *a subsidiary of Thompson Ramo Wooldridge Inc.*

Why MODERN POWER with circumferential expansion action *is important to you is explained in detail in this colorful, illustrated book. Yours FREE when you mail coupon.*

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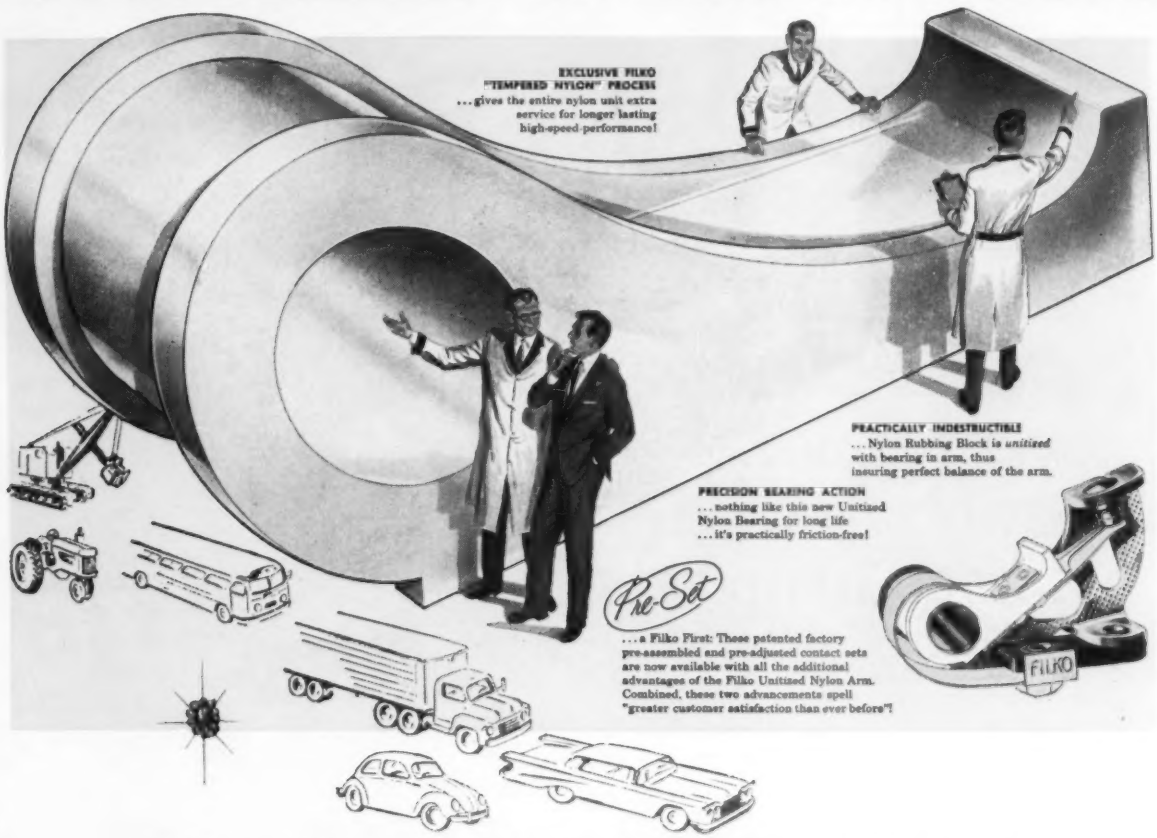
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...gives the entire nylon unit extra service for longer lasting high-speed performance!
PRACTICALLY INDESTRUCTIBLE
... Nylon Rubbing Block is *unitized* with bearing in arm, thus insuring perfect balance of the arm.
PRECISION BEARING ACTION
... nothing like this new Unitized Nylon Bearing for long life
... it's practically friction-free!
Pre-Set
...a Filko First: These patented factory pre-assembled and pre-adjusted contact sets are now available with all the additional advantages of the Filko Unitized Nylon Arm. Combined, these two advancements spell "greater customer satisfaction than ever before"!
FILKO

Filko FIRST WITH COMPLETE LINE!

Bearing—Rubbing Block—Arm—all three are now combined into *one* Unitized Nylon Unit. Here is streamlined, light weight construction that *insures* perfect *precision-set* point alignment for the entire life of the unit!

Again, Filko Completeness lifts the profit limits on this latest ignition achievement... with the *first complete* line of Unitized Nylon Arm Contact Sets—in both "Pre-Set" factory pre-assembled and conventional types—for practically *every* make and model vehicle. Here, again, is another reason why every "Crown Jewel of Ignition" is more than a replacement part... it's a true improvement in ignition!

... another reason why the entire industry is following Filko!

filko *Crown Jewels of Ignition*

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C-903